Preschool Children with Attention Deficit Hyperactivity Disorder: A Naturalistic Assessment of Activity and Sleep.

& Research Portfolio

Part I

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1. Small Scale Service Evaluation Project

Care Programming:

A Survey of the Contributions and Views of Clinical Psychologists Working in CMHT's in Greater Glasgow Community & Mental Health Trust

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Prepared in accordance with notes for contributors for *Health Bulletin*

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Abstract

Objective

To access the views and understanding of clinical psychologist working within CMHT's in Glasgow of Care Programming. To gauge their current level of involvement in Care Programming and to discover the range of services that they are currently providing to this system of care.

Design

A postal questionnaire survey.

Setting

All adult Community Mental Health Teams in Glasgow, Scotland.

Subjects

All qualified clinical psychologists identified to be working within CMHT's in Glasgow providing a service for adults (16-65 years).

Results

Eleven clinical psychologists working within CMHT's completed the questionnaire. All had some knowledge of Care Programming. To date there has been minimal involvement of clinical psychology with this approach. Only 5 of the 11 who responded had been involved with Care Programming clients. The reasons for this lack of involvement are not clear. The sample considered that there were valuable contributions that clinical psychologists could make to Care Programming and felt this approach to be of benefit to client, carer and care provider. Of those involved, 3 considered Care Programming to be an improved approach to the care of clients with severe and long-term mental health problems. The majority predicted that their involvement would increase in the future.

Conclusions

Although aware of Care Programming and working in the environment where this system operates, clinical psychologists have made little contribution to this service. Future involvement will undoubtedly increase. Training and information would be beneficial.

Introduction

The origin of Care Programming lay in an early report by the Social Services Select Committee (1985)[1]. This critical review of community strategies recommended that individuals should not be discharged from hospital without a practical and individualised plan of care that should be collectively devised by all concerned. It emphasized the need for enhanced communication between professionals, monitoring and additional resources. Further to this, guidance on general discharge from hospital was issued by the Department of Health (1989a)[2]. This document stressed the importance of communicating with families regarding discharge, informing community services of patients' needs, therapy assessment prior to discharge and monitoring of care outwith the hospital. Growing public awareness in the late 1980's of what was considered the social consequences of premature discharge from psychiatric hospitals-especially the growth of homelessness and entry into the criminal justice system- reinforced the need to tailor this general approach to people with mental health problems[3]. Simultaneously, the gradual process of downsizing and closure of large institutions within the NHS was well under-way. Consequently, increasing numbers of vulnerable patients were being relocated into the community; however, plans for the restructuring of services had not been fully operationalised to meet this increased demand. In response, the National Health Service

and Community Care Act of 1990 placed great emphasis nationally on the relocation of responsibility and resources into the community with the aim of providing a comprehensive care service for clients with long term mental health problems. Following this, the Department of Health in 1990 issued guidelines requiring health authorities to implement the Care Programming Approach for patients with mental illness referred to specialist psychiatric services[4].

The fundamental aim of Care Programming was therefore to develop a deinstitutionalisation strategy that incorporates user preferences and provides a clear structure for resettlement [5]. Patients identified with severe, long-term and complex mental health problems were to receive continued supervision, care, and packages of services appropriate to their assessed needs. The exact methods to be used in the clinical care of patients were not specified, however, the aim was to establish and develop sound inter-agency and multi-disciplinary collaborative working arrangements.

The Scottish Office Community Care Implementation Unit guided two pilot projects in Scotland, one in Stirling, the other in Glasgow. Care Programming (CP) was piloted in the East sector of Glasgow and based in 3 Community Mental Health Teams (CMHT's). Following the pilot in June to December 1995, a strategy was devised for the phased implementation of the service citywide. The North sector involvement commenced in May of 1996, the South and West of the city following later in the spring of 1997.

There is a growing literature on the implementation of CP [6-11] and on the views of users and carers[12-14]. Research commissioned by the Department of Health noted only minimal

involvement of users and carers [11, 15]. Little information has been gathered from care providers (where care providers refers to CMHT workers, social workers, general practitioners, nursing staff, housing department staff, voluntary agency representatives, etc). Evaluation of the Glasgow service has been made at various stages throughout the phased implementation. Briefly, following a survey of 21 care providers [16](doctors, nursing staff, social workers, housing staff and voluntary workers), this approach was generally considered beneficial for users and multi-agency meetings were found useful. Communication with users and carers was highlighted as an area that required improvement. Concerns about confidentiality were raised and there appeared a need for greater definition of roles and inputs of each agency. Greater dissemination of information about CP was required as half of the GP's surveyed were not aware of their patients being part of CP. Pressures of time and other work priorities were considered barriers to involvement by GP's.

CMHT's are now central to the delivery of mental health care in Britain, and progressively, clinical psychology is becoming an integral part of the service[17]. However, no formal evaluation has addressed the involvement and views of clinical psychologists working within the CMHT's about CP; indeed, it would seem that evaluation of CP in Britain as a whole has largely omitted the views and contributions of clinical psychology.

Research Aims

1. To access clinical psychologists' (working within CMHT's in Glasgow)

understanding of Care Programming.

2. To gauge the current level of involvement of clinical psychologists working in Glasgow CMHT's with Care Programming clients by: -
   - ✦ Considering the number of CP cases they have currently or with which they have had past involvement.
   - ✦ Discovering the range of services they are providing to CP clients.

3. To access the views of clinical psychologists working in CMHT's with Care Programming clients about the following:-
   - ✦ The role of clinical psychologists in CP work and the contributions they can make to this approach.
   - ✦ The effectiveness of CP to case management and care.
   - ✦ The advantages and difficulties in using CP.
   - ✦ Whether CP has made a significant impact on practice.

Methodology

Sample

All qualified clinical psychologists (n =28) identified by the Glasgow Clinical Psychology Directorate database as working within the eleven CMHT's covering the four sectors of Glasgow and providing a service for adult clients (16-65 years) were invited to participate in this study.

Procedure

Information was gathered from 2 sources for this study: -

1. Postal survey questionnaire. Clinical psychologists were contacted by letter (Appendix 1.1) and invited to take part in the present study by completing a questionnaire (Appendix 1.2). Questionnaires were sent to all clinical psychologists working in CMHT's in Glasgow in May 1998. Second mailing occurred one month later to all subjects (as questionnaires were anonymous) to prompt non- responders (Appendix 1.1).

2. Permission was granted for access to the central database for CP at Gartnavel Royal Hospital where all individuals receiving the CP service are registered. The aim of this was to determine the number of registered CP cases in Glasgow.

Materials

The questionnaire used in this study was novel and was designed specifically to derive the information considered to be relevant for the purposes of this research. Permission was obtained to utilize and adapt a selection of relevant questions from the Glasgow Pilot Project evaluation questionnaire. It was considered appropriate, given the small numbers of clinicians involved, that questionnaires should remain anonymous. SPSS was utilized for the analysis.

Results

Response Rate

Of the 28 clinical psychologists who received questionnaires, 17 replies were returned within the four-week period following the questionnaire being mailed. A further 2 responses were received following the prompt letter. This yielded a response rate of 68%. It became apparent that the information obtained from the Glasgow clinical psychology Directorate database, which had identified 28 clinical psychologist as providing a service to CMHT's in Glasgow, was somewhat inaccurate. Of the 19 replies, 8 were returned uncompleted by clinical psychologists working within Adult Mental Health in Glasgow who had been wrongly identified as working within CMHT's. A total of 11 completed questionnaires from the original 28 were received from staff working in CMHT's. There were 9 non-responders and their status as CMHT workers' remains uncertain.

Clinical Psychologists' Understanding of Care Programming.

6 of the sample had received some information about CP mostly through informal discussion, 3 individuals had received information about the Pilot Project, and 3 had received other documentation. However, only 2 of the 11 had been offered and had received training on this approach.

In order to analyze information obtained from open questions, response categories were created by the researcher to accommodate the range of responses provided by the subjects. An independent rater was then utilized to categorize subjects' responses using the response categories created by the researcher. This yielded an 80.3% agreement on

categorization between researcher and independent rater. For those items where discrepancies in categorization between raters were apparent, discussion took place and where necessary, additional categories were developed until agreement was met on every item.

The results indicate that the majority of the sample appeared to have a clear understanding of the key factors relating to the CP approach and the resultant categories were observed to correspond closely to the 'essential elements' outlined in the Glasgow Pilot Project Report. Table 1 illustrates these responses following their categorization.

Insert Table 1 here

The Current Level of Involvement of Clinical Psychologists Working in CMHT's with Care Programming Clients.

Of the eleven respondents, only five reported involvement with the CP system. All five were working within CMHT's that had been formed more than 2 years. Of those involved, two clinicians had been working with the CMHT for longer than 2 years, two for a duration of between 18-24 months, and one had been with the team for less than 6 months. The input to the CMHT's by those clinicians involved with CP was 5 or more sessions per week. None of those involved with CP had received training.

Of the six respondents who had not been involved with CP, all but one of the CMHT's

they work within had been together for more than 2 years. Their level of input into the team and the length of time they had been part of the team were similar to those clinicians who had been involved in CP work.

Of the five clinicians involved with Care Programming, one had a single CP client, two clinicians had two CP clients, one had three, and one failed to report the number of CP clients he/she had involvement with. All those involved had attended review meetings (with a mean attendance rate of 3.8 meetings in total). The role of Keyworker had not been fulfilled by any of the clinical psychologists in this sample. Three had been involved in putting together a patient care plan.

Current level of involvement was perceived as appropriate by two of the five respondents who were involved with CP, the additional three reported that they were involved to a lesser extent than they would like to be. Of the six respondents who were not involved with CP, three felt this was appropriate and three considered that they were involved to a lesser extent than they would like. Four of the five respondents involved with CP predicted that their contribution would increase. One felt 'unsure'. Of the six respondents who had not yet had CP clients, four felt their involvement was likely to increase, the other two felt their level of involvement was likely to stay the same; thus implying that they felt they were unlikely to be involved with CP in the future. Both of these respondents also felt that no involvement was appropriate.

The contribution of clinical psychology in Glasgow to the CP approach therefore would appear to be extremely limited given that, in June 1998, there were a total of 283 CP

clients in Glasgow who had been registered on the Care Programming database (excluding elderly, learning disability, and inpatient clients). Two of the six respondents provided reasons for why they felt they had not been involved with CP. One felt that this was due him/her having had little involvement with this client group, the other felt that this was the result of there being (i) relatively few clients registered with CP, and, (ii) limited resources.

The Range of Services being Provided by Clinical Psychologists to Care Programming Clients

Two clinicians reported involvement in assessment only cases and four had treated CP clients. The tables below outline the range of assessments (Table 2) and treatment types (Table 3) they had delivered to clients. It is noteworthy that twice as many assessments were reported than treatments.

Insert Tables 2 & 3 here

The Views of Clinical Psychologists Working in CMHT's with Care Programming Clients.

Of those clinicans involved with CP, all felt that the CP referrals they had received had been appropriate. Only one clinician felt that CP had made a significant impact on their work in a positive manner by '*improving the exchange of information*' and negatively by '*increasing time demands*'. CP was considered by two respondents not to have made a

significant impact on their work due to (i) few clients of this nature being referred, (ii) being unaware of working in any other way. One of these clinicians considered that (iii) the poor quality of referrals to clinical psychology was a further reason why no significant impact had been made. However, this seems rather contradictory since he or she agreed that all referrals were appropriate. Table 4 displays the contributions clinical psychologists felt they could make to CP. Here, responses were made to an open question and thus were subject to categorisation.

Insert Table 4 here

The benefits and problems with the CP approach as perceived by this sample are displayed in Figures 1 and 2. These were in response to an open question and responses were subject to categorization. The two most popular benefits of CP mentioned were (i) improved communication and sharing of information, and, (ii) an improved treatment process (assessment, treatment and outcome). Of the problems recorded, resource problems (time, staff, administration, training) and difficulty in ensuring attendance at meetings were most frequent.

Insert Figures 1 & 2 here

Care Programming was perceived to be a better system of working by three of the five clinicians involved; two failed to answer this question. Of the six respondents who were not involved with CP, one considered this approach to be a better way of working. Two

felt that the service did not essentially differ from the care this client group would have received before care programming was introduced. All respondents felt that the client benefited from this approach. Ten considered that carers and care providers also benefited.

Discussion

A response rate of 68% was considered reasonable given the nature of the study. However a sample size of 11 was substantially lower than that projected. This was due to inaccurate information being obtained during the search of the Glasgow Clinical Psychology Directorate database regarding the number of clinical psychologists providing a service to CMHT's.

Knowledge of CP

Over half the sample had received some form of information about CP. However, as little as two of the respondents had been offered and received training. Yet the majority of the sample seemed to have a reasonable understanding of the essential factors relating to CP.

Involvement with CP

The most notable finding of the present study was it's demonstration of a low level of involvement with CP by clinical psychologists working within CMHT's in Glasgow. Only five of the eleven respondents had been involved in CP and their level of involvement was limited (mean of 2.0 CP clients per clinician). The services being provided by clinical psychologists to this client group were similar to services they would provide for other CMHT clients. This was as expected, as interventions with CP

clients draw on the generic skills already owned by clinical psychologists and do not require a novel therapeutic approach. Psychologists have been working actively for many years with this client group. Furthermore, the uses of psychological techniques in early intervention, treatment and relapse prevention in psychosis and family interventions are areas which have commanded much research interest and clinical development[18-21]. Therefore, the reasons for this lack of involvement are not obvious given that two of the clinicians in this sample work as full time members of a CMHT, with only two having less than 5 sessions of input each week. One factor which may play an important role in determining the level of involvement in CP, which was unable to be explored in this study, is the way in which individual CMHT's function. The particular individuals who work in a team and how well team members' work together can, in part, determine how well a team functions[22]. In addition, it may be that clinical psychologists are fulfilling particular roles or pursuing areas of interest or specialisms within their CMHT. Another important factor in determining involvement is the source of referrals. With CP referrals being largely at the responsibility of the psychiatrists, there may be a crucial educational role for clinical psychologists to inform their colleagues of the range of services they can provide.

Views of CP

The respondents in this sample unanimously considered the CP approach to be of benefit to the client. Ten of the eleven sampled also judged it to be of benefit to both carers and care providers. Although problems with CP were highlighted (Figure 2), the majority of those with experience of CP considered it to be an improved way of working. Enhanced communication and sharing of information as well as an improved treatment process

were amongst the most frequently recorded benefits (Figure 1). It was clear from the response that clinical psychologists felt they had valuable contributions to make to CP, for instance, in the provision of a consultative service and the delivery of psychological assessments and treatments (Table 4). It was predicted by eight clinicians that their involvement was likely to increase in the future and the majority wished greater involvement in CP.

Limitations

Some of the limitations of the present study are intrinsic to the small-scale design of the project. However, due to inaccurate information regarding the number of clinical psychologists working in CMHT's in the area, small numbers of respondents prevents generalisation of these findings to clinical psychologists working in other localities.

Conclusions

Given that CP is yet in its infancy it is expected, with its more recent implementation across elderly and learning disabled services, that clinical psychologists' involvement with this approach will undoubtedly increase. CP approach appears compatible with current clinical psychology service delivery. The pattern of referrals to clinical psychologists from the CMHT's, to some extent, dictates their level of involvement. Clinical psychologists have thus an educational role to fulfil by informing colleagues of their skills and the likely contributions they could make to CP. The provision of training and literature on this approach would be beneficial.

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Categorized Responses	Number of Respondents reporting this item (n=11)
Provision of a package of care involving assessment, planning and implementation	8
Multi-professional (sector/discipline/agency)	6
Co-ordinated approach to the management of care	6
Targeted at the long term severely mentally ill	6
Regular monitoring and review	5
Users views and carers views are appropriately represented	3
Goal is to provide rehabilitation and support from the hospital to the community	2
Built-in accountability & responsibility	2
Manages 'at risk' clients in the community	2
Other	2

Table 1. **Key Factors Relating to Care Programming Identified by Clinical Psychologists.**

Type of Assessment	Total cumulative No. of Assessments for those involved in Care Programming (n=5)
Neuropsychological	3
Risk assessment	2
Diagnosis	5
Level of Functioning for rehabilitation	2
Suitability for psychological treatment	6
Systemic Assessment	1

Table 2. **Assessments Delivered by Clinical Psychologists to Care Programming Clients.**

Type of Treatment	Total cumulative No. of Treatments for those involved with Care Programming (n=5)
Cognitive Behaviour Therapy	5
Behaviour Therapy	1
Social Skills Training	2

Table 3. **Treatments Delivered by Clinical Psychologists to Care Programming Clients.**

Categorized Responses to an Open Question	**Frequency of Responses** (n=10)
Important role in treatment	5
Supervisory/ consultancy role	4
Important role in assessment	4
Fits with the scientific method of defining goals and measuring outcome	3
Assist with the planning of care	3
To make a valuable contribution to multi-disciplinary teams	1
Forensic role for those clients considered 'at risk'	1
Unsure	1

Table 4 ***The Contributions Clinical Psychologists Consider they can make to Care Programming***

Figure 1 Benefits of Care Programming

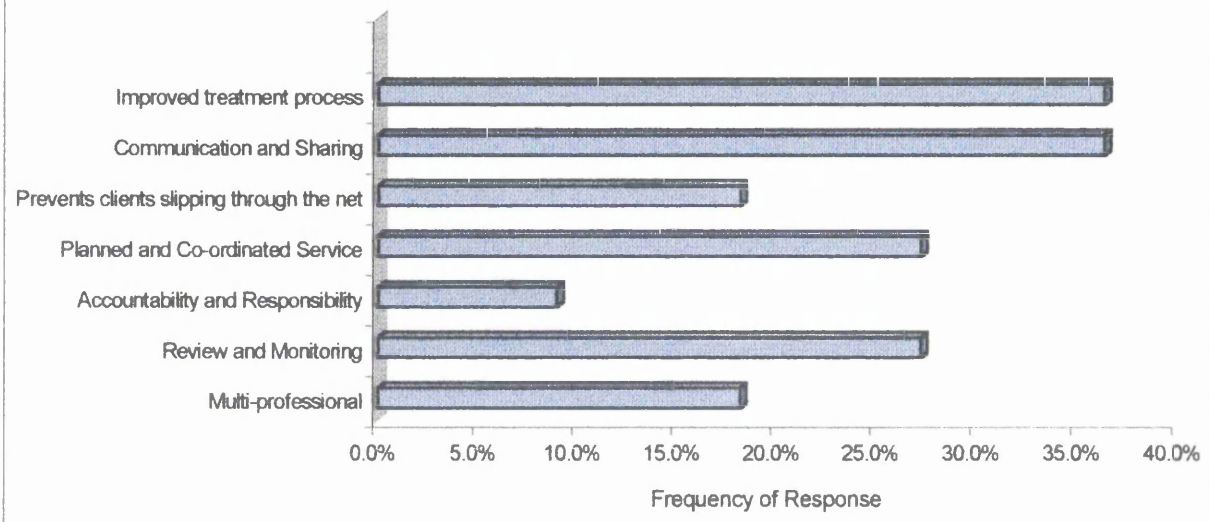
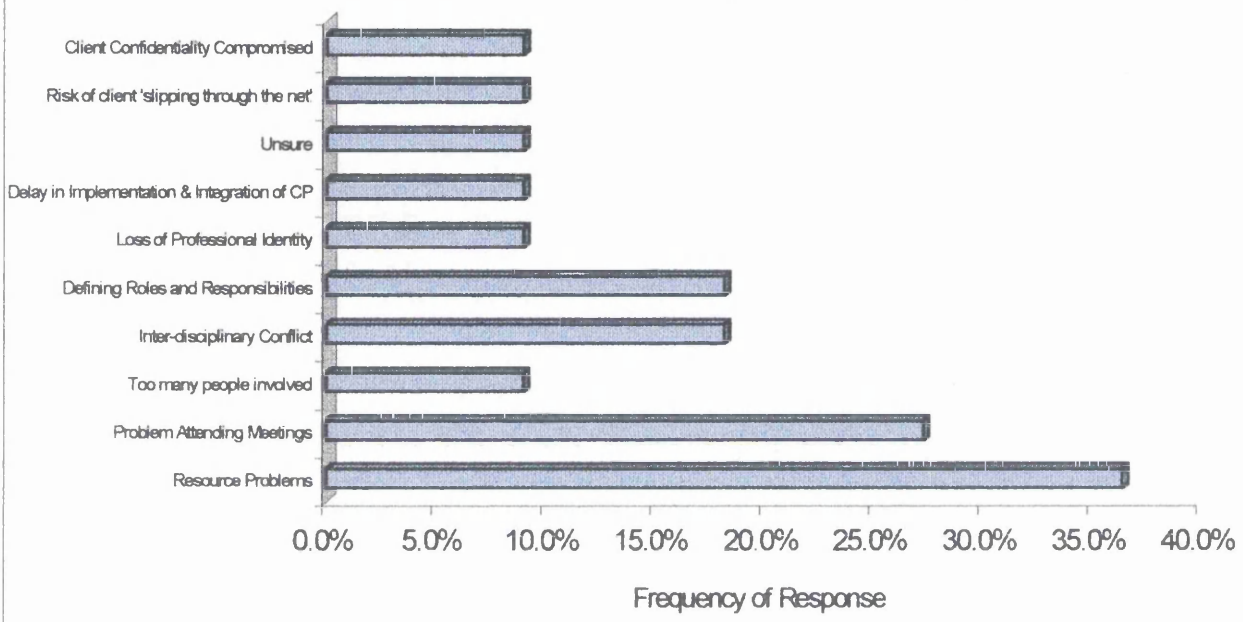


Figure 2 Problems with Care Programming



2. Major Research Project Literature Review

Activity and Sleep in Children with Attention Deficit Hyperactivity Disorder-A Review.

Prepared in accordance with notes for contributors for:

The Journal of Child Psychology and Psychiatry and Allied Disciplines.

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Abstract

The diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) continues to evoke considerable debate amongst researchers and clinicians. The aetiological factors underpinning the genesis of this disorder are not well understood. Research has focused on the area of arousal and several lines of evidence suggest that sleep disorders may play a role (Chervin, Dillon, Bassetti, Ganoczy & Pituch, 1997). Studies investigating the sleep patterns and activity patterns of these children have been undertaken. The outcomes of these studies are reviewed. It is suggested that much of the literature in this area has used experimental methodologies that have yielded contradictory findings. However, consistently, children with ADHD have been found to exhibit greater daytime activity and restlessness during sleep when compared to their normal peers. Few studies can be found which address activity and sleep concurrently in children with ADHD and research involving the preschool hyperactive child would appear to be a neglected area. Further research in this area is required to bring clarity to the understanding of the role of sleep disturbance and activity in ADHD both from a clinical and theoretical perspective.

Attention Deficit Hyperactivity Disorder

Continuing controversy exists surrounding the subject of Attention Deficit Hyperactivity Disorder (ADHD). Despite this being the most widely researched area in Child and Adolescent Psychiatry (SIGN, 1999), a lack of consensus regarding both the definition and management of this disorder persists. Consequently, the Scottish Intercollegiate Guidelines Network (SIGN) is currently making ADHD the subject of the first SIGN guidelines on child and adolescent psychiatric disorders. ADHD is indeed the most common neurobehavioural disorder of childhood affecting the full span of development from preschool to school-age even continuing into adult life (Shaywitz, Fletcher & Shaywitz, 1997). From the current literature the term ADHD is implicitly equated with the behavioural characteristics of inattention, hyperactivity and poor impulse control. The clinical diagnostic elements of Attention Deficit Hyperactivity Disorder (DSM-IV) and Hyperkinetic Disorder (HD), the term used by the International Classification of Diseases (ICD-10), are essentially equivalent although slight variation in the diagnostic ruling exists (Hill & Cameron, 1999). ICD-10 provides more restrictive criteria, whereas DSM-IV requires either six inattention items or six hyperactive/impulsive items for diagnosis, ICD-10 Diagnostic Criteria for Research requires at least six inattention items, at least three hyperactive items and at least one impulsive item to be present (Figure 1).The difficulty reported with the diagnosis of this disorder is due to a number of factors. Co-morbidity and differential diagnosis create substantial problems for the clinician (Hill & Cameron, 1999)- in addition, symptoms diagnostic of ADHD manifest a developmental trend. It has been noted that activity levels increase until the age of three years but then gradually decline so that by adolescence gross motor hyperactivity is no longer present. Too often, it is mistakenly assumed that children who are no longer exhibiting gross

motor hyperactivity are free of problems and much needed support is withdrawn (Shaywitz, Fletcher & Shaywitz 1997). Attention deficits are found to persist through the years. The symptoms of ADHD are susceptible to altered expression across different environmental contexts and can depend on task demand. There is a noted unpredictability of children's behaviour who have ADHD from one minute to the next or from one day to another even when observed in similar situations. ADHD is a particularly serious problem because children with the core symptoms of inattention, overactivity and impulsivity may develop secondary academic and relationship problems (Carr, 1999). A wide range of prevalence estimates have been reported and reflect the difficulties inherent with diagnosis. DSM-IV reports a prevalence rate of between 3% and 5%. ADHD is reported to be four times more prevalent in boys than girls (SIGN, 1999). Disorders of hyperactivity arise early in a child's development, usually during the preschool years.

Insert Figure 1 Here.

Conceptualisation of ADHD

The pathogenesis of ADHD is poorly understood. Numerous theories have arisen to provide an explanation for this disorder amongst which the following areas have been investigated- neurochemical abnormalities, environmental influences, neurophysiological irregularities, structural brain anomalies and genetics. Much of the findings have proven inconclusive, although there is evidence from various lines of research which clearly

demonstrates the contribution of genetic factors to ADHD (SIGN, 1999). Constitutional abnormalities are thought to play a crucial role in the origin of this disorder but it is likely that these behaviours have multiple causes.

A few theoretical lines of investigation concentrate upon activity, arousal and sleep. Some researchers investigating activity in the ADHD child have proposed that ADHD might best be understood as a personality dimension (Pinto & Tryon, 1996). Activity levels in the ADHD child have been found to alter with different environmental demands- however, activity remains relatively stable within a distribution of activity for the individual. The authors support their conclusion that activity is a stable childhood trait with evidence from prenatal studies demonstrating that activity is a stable individual difference found between the 16^{th} and 20^{th} week of gestation. Although this presents an interesting conceptualisation of ADHD, it requires further clarification and validation, and currently adds little to our overall understanding of the mechanisms underlying this disorder.

Other researchers have focused upon the global concept of arousal and quite opposite explanations for ADHD have been advanced. One line of investigation proposed ADHD to be a reaction to excessive stimulation (Strauss & Lehtinen, 1947). Children with ADHD were considered unable to properly filter and organise information leading to 'stimulus overload' resulting in overactivity. An alternative theory suggested increased motor activity to be stimulus-seeking behaviour resulting from CNS hypoarousal (Zentall, 1975, 1977). Given the relationship between the mechanisms regulating arousal and sleep states, it might be expected that the sleep of individuals who experience

difficulties in the regulation of arousal would be affected. Hyperaroused ADHD children might be expected to display greater amounts of lighter sleep reflecting an endogenously hyperaroused CNS. Also, greater frequency in movement during sleep may be expected of a centrally hyperaroused state influencing motor systems throughout sleep. Increased CNS excitability is associated with reduced REM onset latencies and increased REM amounts found in narcoleptics and depressives (Montplaisir et al., 1978; Kupfer, 1976) and in subjects recovering from REM deprivation (Derment, 1960). Alternatively, increased amounts of light sleep and motility during sleep could also be explained using the hypoarousal theory, as reductions in levels of arousal in an already hypoaroused nervous system could initiate internally generated stimulation to counter decreased sensory stimulation. Findings from early hypnopolygraphic studies have been somewhat contradictory and generally have failed to demonstrate sleep alterations specific to ADHD consistent with either of these theories. Interestingly, a more recent line of research has supported the notion of a deficit in the regulation of arousal in relation to environmental requirements. Findings have suggested that children with ADHD may experience hypoarousal in situations requiring sustained attention; however, in novel situations or situations involving immediate reward, they show hyperarousal (Douglas 1984, 1985). It was postulated that this difficulty with modulation of arousal would also lead to unstable patterns of sleep in ADHD children. Ramos Platon, Bueno, Sierra and Kales (1990) found evidence in support of this theory of poorly modulated arousal. Their findings of reduced sleep onset latency, increased number and length of awakenings, lower sleep efficiency and altered sleep stage pattern in the ADHD sample were explained by rapid alterations in arousal levels during sleep. Parallels were drawn between the sleep pattern of ADHD children and individuals with narcolepsy. Increased

number of awakenings, increased stage 1 sleep and greater daytime activity have been found to be present in both groups. Here, disorganised motor arousal during daytime was considered to be an effort to maintain neurophysiological arousal to avoid somnolence. Additionally, abrupt rather than gradual alterations between states of sleep and wakefulness were discovered to be characteristic of both the narcoleptic and ADHD samples and they surmised that this was due to deterioration in the neurophysiologic control of the sleep-wake cycle. From their findings they concluded that deficit control of the level of neurophysiological arousal produced marked oscillations in the maintenance of both sleep and wakefulness states, and altered the degree of behavioural arousal which, in turn, interfered with the child's response to the environment. However, caution must be taken when interpreting these findings given the small sample sizes used. Validation of these findings by replication and increased numbers of subjects is required. To date, the literature is ambiguous and the aetiological factors under-pinning deficient arousal in children with ADHD are not well understood. Other researchers hold that sleep may in fact play a more central role in the presentation of ADHD. Dagan and colleagues (1997) propose that poor sleep quality could itself be causal of the behavioural characteristics of inattention, impulsivity and hyperactivity that is, children with ADHD become very active during daytime in an effort to overcome tiredness. Otherwise, ADHD children may exhibit higher levels of activity both during the day as well as at night due to a yet unknown psychological or neurological cause. Uncertainty persists over the relationship between sleep disorders and the behavioural characteristics of inattention, impulsivity and hyperactivity in children with ADHD.

ADHD and Disorders of Sleep

Elevated rates of sleep disorders of varying forms have been reported in child psychiatric groups compared with other children (Salzarulo & Chevalier, 1983; Simonds & Parraga, 1984). Researchers and clinicians working in the field of ADHD have long recognised the importance of sleep problems in these children.

The role of sleep and wakefulness in ADHD merits close scrutiny when we consider that inattention, impulsiveness and restlessness- core symptoms of the disorder- have been recognised as characteristics of sleep deprivation (Kleitman, 1965). So central to the presentation of ADHD, symptoms of sleep disruption were once included in the diagnostic criteria for the disorder (DSM-III), although these have been excluded in the last two versions perhaps due to problems with differential diagnosis. However, sleep problems are included on a number of child rating scales which are often used to aid the diagnostic procedure. Parents of children with ADHD often report settling difficulties, night waking, restless sleep and early morning waking in their children. Objective and systematic measurement of the sleep pattern of these children has often proved unsuccessful in supporting these complaints (Kaplan, McNicol, Conte & Moghadam, 1987). Despite this, the perception still persists that children with ADHD have greater sleep-arousal difficulties than non-ADHD children. There is evidence to suggest that when sleeplessness is observed in the overactive child, corrective measures aimed at improving the sleep should be attempted as, in some cases, it has been noted that the behavioural characteristics of ADHD may result from poor sleep (Stores, 1996). In cases where the ADHD symptoms are not entirely attributable to a primary sleep disorder, better sleep can lead to positive and significant improvements in daytime functioning (Dahl , Pelham & Weirson, 1991).

Techniques for the Measurement of Sleep Difficulties

Sleep research can be divided into two main areas based on the methods used for assessing sleep problems- subjective and objective measurements (Wiggs & Stores, 1995). Subjective measurements focus on directly observable aspects of sleep and take the form of questionnaires, diaries and interviews. These often tend to be retrospective in nature, with the exception of the sleep diary which is a daily log of sleep variables recorded by the individual and/or an observer. Many of the earlier studies investigating sleep problems in children relied upon subjective parental reports of children's sleep.

Numerous attempts have been made over the years to objectively measure sleep, the first study being carried out as early as 1922 (Szymansky). A variety of devices have been developed for this purpose among which are photographic monitoring devices, video recording, electroencephalogram (EEG) movement artifacts, bed and body transducers and pressure sensitive mattresses. Nocturnal polysomnography carried out in a sleep laboratory over two or more consecutive nights is considered the gold standard assessment tool to identify sleep difficulties. Recently, the use of activity-based sleep assessment has gained considerable prominence amongst sleep researchers and clinicians. Actigraphy has become popular as it permits objective measurement in a naturalistic setting over an extended period of time. The actigraph is based on a miniaturised acceleration sensor that translates physical motion into a numeric representation. This monitoring system is the size of a digital wristwatch and is attached to the wrist (or ankle) of an individual for prolonged periods of time, providing continuous activity data with little interference imposed on the subject (Sadeh, Hauri, Kripke & Lavie, 1995).

Techniques for the Measurement of Daytime Activity

Similar to the measurement of sleep parameters, early studies of motor activity involved retrospective reports and observational information (Zentall, 1980). Difficulties were encountered as observational measurement systems, such as quadrant changes in grid marked rooms, measure only gross locomotor activity and are probably not sensitive to fidgetiness and restlessness-which are among the most common complaints about hyperactive children (Porrino et al., 1983). However, various objective measurement devices have been developed to quantify motor activity during wakefulness. Such devices as step-counters, photoelectric cells, stabilimeters, ultrasound and infrared detectors have been designed or utilised for this purpose. Advances in computer and video-processing technology have also led to the development of motion-analysis systems that can precisely track 2 or 3 dimensional positions of an object several times per second (e.g. MacReflex System) (Teicher, 1995). Actigraphy has become popular and this technique is now being widely used for motion analysis in clients with a number of diverse psychiatric conditions (Teicher, 1995).

Actigraphy is flexible in its application. It appears to be the only objective measuring device that can be utilised to quantify activity during daytime as well as during the night. In addition, software packages are available which calculate sleep-wake parameters based upon activity data, thus permitting a detailed analysis of sleep.

Sleep Disturbances in ADHD Children- Research Outcome

Despite many clinical observations and theoretical speculations regarding the association of sleep disturbance in children with ADHD, it's significance remains undetermined.

Parental accounts of sleep disturbance in children with ADHD would appear to be the impetus for research in this area. A recent and comprehensive review of the literature on sleep disturbance and ADHD has been provided by Corkum and her colleagues (1998).

Corkum gathered information from sixteen studies since 1970 and, using a 'box-score' approach, examined the consistency of findings across studies which had differing measures of outcome. Of the sixteen studies, two used subjective measures of sleep (Trommer, Hoeppner, Rosenberg, Armstrong & Rothstein, 1988; Kaplan et al., 1987). These studies demonstrated that parents of children with ADHD report significantly more sleep disturbance when compared with normal children. Difficulties falling asleep were reported in 56% of the ADHD sample (n=48) versus 23 % of controls (n=30), tiredness upon waking was reported in 55% of ADHD sample versus 27% of controls (Trommer et al., 1988). Kaplan and colleagues (1987), in a series of three studies (two retrospective and one using daily sleep diaries), found increased night waking and shorter daytime naps in a sample of preschool children with ADHD but no difference was found in sleep onset latency or total sleep time when compared with controls.

A further fourteen studies utilising objective measurement techniques were also reviewed- two studies used actigraphy and the other 12 used polysomnography. Table 1 provides a summary of some of the relevant findings.

Insert Table 1 Here.

Nine studies addressing sleep onset latency found it to be the same for ADHD and controls in 45% of the studies, longer in 33% and shorter in 22%. Total sleep time was found to be equivalent for ADHD children and controls in 90% (9/10) of the studies, and greater for ADHD children in the one other study. Eight studies looked at sleep efficiency (percentage of sleep from sleep onset to time of waking) and found it to be poorer for ADHD children in 38 % of the studies, and the same as controls in 62%. The six studies that measured movement during the sleep period found ADHD children to be more restless than controls in 67% of the studies, and equal to controls in the remaining studies. It therefore proves difficult to draw meaningful conclusions with regards to the difference in sleep parameters between children with ADHD and normal controls due to inconsistencies in the findings.

Sleep architectural differences were also investigated. Five of the nine studies investigating REM sleep noted differences between ADHD and normal children. Three studies reported reduced REM in ADHD children (Greenhill, Puig-Antich, Goetz, Hanlon & Davies, 1983; Nahas & Krynicki, 1977; Ramos Platon et al., 1990), the other two reported a longer latency to first REM period in ADHD children (Busby, Firestone & Pivik, 1981; Haig, Schroeder & Schroeder, 1974). Ramos Platon et al. (1990) found reduced REM to be associated with the hyperactivity component rather than the inattentive component of ADHD and relates this to an instability of sleep in ADHD children. Results from studies comparing NREM sleep were also inconclusive. Those studies concerned with the effects of stimulant medication were also reviewed. Alterations to the sleep pattern following the introduction of stimulant medication were noted in 6 of the 8 studies (75%), where medication was noted to prolong sleep latency

(Tirosh ,Sadeh, Munvez & Lavie, 1993) and lengthen the onset to the first REM cycle (Feinberg et al., 1974; Small, Hibi & Feinberg, 1971).

In summary, many of the findings were inconclusive and only two relatively consistent findings across the 14 studies were observed. Firstly, children with ADHD exhibit more movement during sleep (67%) than controls. Polysomnography appeared to be less sensitive to these differences than actigraphy. Secondly, the total sleep time was no different for the ADHD group and control group in 90% of the studies.

However, several methodological issues were raised by Corkum and colleagues with these studies which may account for some of the inconsistencies in the research findings. Sample sizes were generally small (number of ADHD subjects in studies using objective measurement ranged from 3 to 16, mean 8.4) and inadequacy of control procedures was commonplace (especially regarding the matching of age and gender). There was wide-ranging variability in the type, number, and manner of techniques for assessing sleep parameters. Inconsistencies and inadequacies were observed in the application of diagnostic criteria (for example, some studies used parent or teacher rating scales, some relied on previous diagnosis, others did not state their diagnostic criteria). In addition, many of the ADHD subjects were not medication-naïve. It is known that the time of recording can affect activity recordings (Porrino et al., 1983), however, frequently researchers were found to have failed to document this. Additional difficulties lay with the disregard of psychosocial factors (e.g. bedtime routine) and structural variables (sleeping arrangements, allowing for naps, etc.) that may account for differences in sleep. Lastly, the ecological validity of using polysomnography with a child sample was

brought into question.

In addition to those studies reviewed by Corkum and colleagues, one further study investigating the sleep quality of children with ADHD was cited. Dagan et al. (1997) compared the sleep of 12 male children (6-12yrs) diagnosed as ADHD by a senior psychiatrist with that of 12 normal controls using actigraphy. Findings from this study indicate that ADHD children have poorer sleep quality- that is, lower sleep efficiency and higher activity during sleep when compared with controls. They also observed that the sleep quality of the two groups differed over the course of the night. A linear decrease in the sleep quality of controls was observed, a finding that was predictable and expected. However, an unexpected downward trend in sleep quality of ADHD children was noted at the beginning of the night, followed by an upward trend in the third and fourth night-quarters. Although this difference was not significant [$F(3,66) = 2.65$, $p=0.06$)], it warrants further investigation. Unfortunately, many of the criticisms made by Corkum and her colleagues regarding the methodological flaws with the research in this area are also relevant to this study. The sample size was small and the controls poorly matched for age (average age ADHD 9.6 + 1.6, average age controls 7.9 +1.2). Five of the twelve children in the experimental group were taking stimulant medication during the time of recording. No mention was made as to whether recording took place at weekends or weekdays. In addition, the researchers failed to stipulate on which wrist the actigraph was to be attached. It is common practice to place the actigraph on the non-dominant wrist as activity levels of different limbs may vary significantly (Sadeh et al., 1995). These factors may have confounded some of the findings.

Activity in ADHD Children- Research Outcome

Altered locomotor activity is considered a cardinal sign of ADHD. Numerous attempts have been made to develop objective measures to demonstrate that children with ADHD are in fact hyperactive. Early research yielded ambiguous findings and this was thought to be due to the variability in the measurement techniques utilised (Barkley & Ulman, 1975). An early study by Barkley and Ulman (1975) measured activity across thirteen categories in a sample of 16 boys (4-12yrs) with ADHD during a 15-minute free-play and a 5-minute test situation. A clinical control group (n=16) and community control group (n=20) were used as comparisons for activity and distractibility measures. Actometers (Timex Motion Recorders which measure the number of minutes of activity over a given time) and pedometers (measuring the number of yards of activity over a given time) were used to measure activity. Results indicated that ADHD boys displayed greater wrist and ankle activity during free play when compared to other children and were rated by their parents as more active than other children. No consistent relationship was found between distractibility and activity. Actomoter measures of ankle or wrist movement have been found consistently to be higher for hyperactive children than normal control children in structured situations. Less support can be found for overactivity during free-play (Kaspar, Millichap, Backus, Child & Schulman, 1971). These results were compatible with the findings from observational studies (Zentall, 1980; Jacob, O'Leary, Rosenblad, 1978).

Motor excess in ADHD is currently treated qualitatively because it is thought to occur primarily, if not exclusively, under highly structured situations where attentional demands are high. However, considerable concern exists over the methodologies of these studies. Most importantly, few studies have included activity measurement in the child's

natural environment over an extended time interval. A study by Pinto & Tryon (1996) provides a notable exception. They measured the physical activity of 22 hyperactive boys (≥2 sd's above the mean for age and sex on the Conner Rating scale), 7 overactive boys (>1, <2 sd's) using a digital electronic step counter. Comparisons were made with 31 matched controls. All participants were male and between the ages of 6 years and 12years. Each subject wore the digital electronic step counter, which measures steps taken by the individual, at the waist, for a period of 2 weeks (10 school days and 4 weekend days). The recording device was removed at bedtime. The results indicated that hyperactive children are more active than normal children in unstructured as well as structured situations. They conclude that children retain their relative positions within a dimension of activity despite changes in absolute activity levels across situations and despite variations in attentional demands.

Teicher and colleagues (1991), using a Motionlogger actigraph studied the rest-activity levels and rhythms in children with ADHD. Waist-worn activity monitors recorded three days of activity data from 11 children with ADHD. This was compared to 6 children with bipolar disorder in manic or mixed state, 13 depressed children and 12 normal controls. The distribution of activity scores (percentage of time spent at low, medium and high activity) rather than mean levels of activity were compared. ADHD children were found to have activity distributions that were skewed towards high levels and seven of the eleven displayed activity levels that were more skewed towards high levels than those of children in any other group. The authors argue that this parameter is more reliable than mean activity levels at identifying children with ADHD as mean activity levels were found to overlap significantly among groups. They conclude that hyperactivity of

children with ADHD appears to be due more to the relative absence of quiescent periods than to presence of periods of extreme activity.

Activity and Sleep in ADHD Children- Research Outcome

Despite the advances in measuring devices, only one study could be sourced which attempted to quantify activity during sleep as well as during daytime. Porrino and colleagues (1983) monitored activity continuously over 24 hours in the child's natural environment. The activity of twelve boys aged 6-12years, diagnosed as hyperactive, was continuously monitored over one week using a belt worn accelerometer (Motionlogger, Ambulatory Monitoring). Activity measures were compared to 12 age and classroom matched normal boys. All experimental subjects were ($\geq$2 sd's) above the age DSM-IV hyperactivity norms for the Conner Rating Scale and displayed hyperactivity at home, during the interview and during psychological testing. Children with seizure related disorders, major psychiatric disorders and those falling below an IQ of 80 were excluded from participation. The belt was worn continuously around the waist of each child for 7-10 days, measuring truncal activity. Children, with help from their parents, completed hourly diaries of their activities. Results indicated that hyperactive children were significantly more active than control boys during weekday and weekend activities. Hyperactive children were considerably more active during structured classroom time (mathematics and reading) than normal children; however, during intervals both groups increased substantially in activity but did not differ significantly from each other. Hyperactive children were found to be significantly more active during outside play after school but not during inside play and while watching television on weekdays. The findings from this study were consistent with others in that there appears to be a

classroom structure and hyperactive behaviour interaction effect (Zentall, 1980; Jacob, O'Leary & Rosenblad, 1978). At weekends, in a variety of situations with differing degrees of structure and attentional demands, hyperactive children showed consistently higher levels of motor activity than did their normal controls. During sleep, hyperactive children were found consistently to exhibit more movement whilst asleep during school nights, but not at weekends, when compared with controls. The authors failed to provide an explanation for this finding. This is perhaps due to them having focused singularly on motor activity during sleep and thus having gathered insufficient information about other important sleep parameters.

Conclusions

There continues to be considerable confusion and contradiction within the literature addressing the sleep and activity of children with ADHD. It is suggested that much of this is due to the existing research being hampered with methodological flaws. However, advances have been made possible by the availability of improved objective measurement devices that are affordable, compact and portable. Children with ADHD appear to be more active when compared with their normal peers during the day, and this overactivity is apparent with some consistency across situations and irrespective of time. These children have consistently been found to sleep for the same duration as their normal peers; however, the quality of their sleep would seem to be poorer as they are subject to restlessness during the night. Parents of children with ADHD report more difficulties with their children's sleep than parents of normally developing children. However, objective measurement has largely failed to support these reports. It may be that parents of ADHD children have a perceptual bias. Perhaps these parents have

increased awareness of, or sensitivity to, problem behaviour borne out of a necessity to keep constant vigil over their very active child.

The link between sleep disorders and ADHD is not well understood and no theory to date provides an adequate explanation for this. Further research in this area is required to bring clarity to the understanding of the association between sleep and ADHD both from a clinical and theoretical viewpoint. Increased knowledge of the type, frequency and duration of sleep disorders in children with ADHD and how these may relate to daytime functioning and activity is required. Currently, a link between sleep disorders and ADHD has been firmly established; clinicians working in this field should be including a comprehensive appraisal of sleep within their general assessment framework.
Lastly, an important and neglected area lies with the investigation of the rest-activity patterns of the preschool child with ADHD. It would appear that there are no studies using objective measurements to investigate activity and sleep in this group in spite of existing evidence that these children are more likely to exhibit hyperactivity than older ADHD children (Shaywitz, Fletcher & Shaywitz, 1997). Possession of a primary hyperactivity disorder is a potent vulnerability factor for the development of other emotional and behavioural difficulties and long term outcome in social, occupational and educational terms is generally poor (Hill & Cameron, 1999). Therefore, there is a great need for researchers and clinicians to address this problem at the earliest possible stage.

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Figure 1.

ICD-10 Research Diagnostic Criterion for Hyperkinetic Disorders (F90)

Note: The research diagnosis of hyperkinetic disorder requires the definite presence of abnormal levels of inattention, hyperactivity, and restlessness that are pervasive across situations and persistent over time and that are not caused by other disorders such as autism or affective disorders.

G1. *Inattention.* At least six of the following symptoms of inattention have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often fails to give close attention to details, or makes careless errors in schoolwork, work or other activities;
2. often fails to sustain attention in tasks or play activities;
3. often appears not to listen to what is being said to him or her;
4. often fails to follow through on instructions or to finish schoolwork, chores, or duties in the workplace (not because of oppositional behaviour or failure to understand instructions);
5. is often impaired in organising tasks and activities;
6. often avoids or strongly dislikes tasks, such as homework, that require sustained mental effort;
7. often loses things necessary for certain tasks or activities, such as school assignments, pencils, books, toys, or tools;
8. is often easily distracted by external stimuli;
9. is often forgetful in the course of daily activities.

G2. *Hyperactivity.* At least three of the following symptoms of hyperactivity have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often fidgets with hands or feet or squirms on seat;
2. leaves seat in classroom or in other situations in which remaining seated is expected;
3. often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, only feelings of restlessness may be present);
4. is often unduly noisy in playing or has difficulty in engaging quietly in leisure activities;
5. exhibits a persistent pattern of excessive motor activity that is not substantially modified by social contexts or demands.

G3. *Impulsivity.* At least one of the following symptoms of impulsivity has persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often blurts out answers before questions have been completed;
2. often fails to wait in lines or await turns in games or group situations;
3. often interrupts or intrudes on others (e.g. butts into others' conversations or games);
4. often talks excessively without appropriate response to social constraints.

G4. Onset of the disorder is no later than the age of 7 years.

G5. *Pervasiveness.* The criteria should be met for more than a single situation, e.g. the combination of inattention, and hyperactivity should be present both at home and at school, or at both school and another setting where children are observed, such as a clinic. (Evidence for cross-situationality will ordinarily require information from more than one source; parental reports about classroom behaviour, for instance, are unlikely to be sufficient.)

G6. The symptoms in G1-G3 cause clinically significant distress or impairment in social, academic, or occupational functioning.

G7 The disorder does not meet the criteria for pervasive developmental disorders (F84.-), manic episode (F30.-), depressive episode (F32,-), or anxiety disorders (F41.-).

SLEEP PARAMETER MEASURED	*TOTAL NO. OF STUDIES*	*FINDINGS (no. of studies)*	*STUDIES*
Sleep Onset latency (SOL)	9	ADHD > Control (3) ADHD < Control (2) ADHD = Control (4)	Busby & Pivik, 1985; Haig et al., 1974; Palm et al., 1992. Ramos Platon et al., 1990, Small et al., 1971. Busby et al., 1981; Feinberg et al., 1974. Greenhill et al., 1983; *Tirosh et al., 1993.
Total Sleep Time (TST)	10	ADHD >Control (1) ADHD =Control (9)	Ramos Platon et al., 1990. Busby et al., 1981; Busby & Pivik,1985; Feinberg et al., 1974; Greenhill et al., 1983; Haig et al., 1974; Khan & Rechtschaffen, 1978; Small et al., 1971; Stahl et al ., 1979; *Tirosh et al., 1993.
Sleep Efficiency (SE)	8	ADHD <Control (3) ADHD =Control (5)	Palm et al., 1992; Ramos Platon et al., 1990; Stahl et al., 1979. Busby et al., 1981; Feinberg et al., 1974; Greenhill et al., 1983; Small et al., 1971; *Tirosh et al., 1993.
Movement During Sleep	6	ADHD >Control (4) ADHD =Control (2)	Busby et al., 1981; *Porrino et al., 1983; Small et al., 1971; *Tirosh et al., 1993. Greenhill et al., 1983; Nahas & Krynicki, 1977.

*actigraphy, all others polysomnography.

Table 1 Results of Sleep Studies using Objective Measurement.

3. Major Research Project Proposal

Preschool Children with Attention Deficit Hyperactivity Disorder - A Naturalistic Assessment of Activity and Sleep.

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Stephanie Jill Inglis BSc. (Hons)

Prepared in accordance with guidelines in the D.Clin. Psy. Handbook, based upon the application for a mini-project grant in Health Service Research (SOHHD-Chief Scientist Office).

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TITLE OF PROPOSED STUDY

Preschool Children with Attention Deficit Hyperactivity Disorder -A Naturalistic Assessment of Activity and Sleep.

SUMMARY

Researchers and clinicians in the field of Attention Deficit Hyperactivity Disorder have recently recognised the importance of sleep problems in children with ADHD. However, little is known about the circadian rest-activity pattern of the preschool child with ADHD. The proposed study aims to investigate the nature of sleep and activity in a sample of preschool children with ADHD relative to controls (children without the disorder). Actigraphy will be utilised to objectively measure activity and will also provide valuable information on the sleep quality and sleep pattern of subjects. It is intended that subjects participating in this study will be recruited from three outpatient Child Centres, two located in Glasgow (The Royal Hospital for Sick Children -

Psychiatry hospital outpatients and Psychology community outpatients), the other in Paisley (Panda Centre, Child Development Assessment Centre, Hawkhead Hospital). Subjects who are awaiting treatment of Attention Deficit Hyperactivity Disorder will be identified by clinicians at these recruitment sites. The control group will be accessed via parents of the subjects who will be asked to volunteer, where possible, a child of the same sex and age for inclusion in the study. Where necessary, additional control subjects will be accessed via a nursery.

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is the most common neurobehavioural disorder of childhood, affecting the span of development even into adult life (Shaywitz, Fletcher & Shaywitz, 1997). Core symptoms are essentially behavioural characteristics i.e. inattention, hyperactivity and poor impulse control. DSM-IV provides the most widely recognised diagnostic criteria, however, the diagnosis of ADHD continues to evoke considerable debate. This may, in part be due to the fact that symptoms diagnostic of ADHD manifest a developmental trend, for example, until the age of 3 years activity levels increase but then follow a downward trend so that by adolescence gross motor hyperactivity is no longer present. Not only do symptoms of ADHD alter with time; they exhibit situational variability. Difficulty with diagnosis has confounded prevalence estimates. Recent literature suggests a prevalence rate of between 3 and 9% in school-aged children (Teicher, 1995) with a male/female ratio of 4:1 (SIGN, 1999). Disorders of hyperactivity arise early in development, usually within the first five years of life. Constitutional abnormalities are thought to play a crucial role in the genesis of this disorder but present knowledge of specific aetiology is lacking.

Sleep problems are a common manifestation of ADHD and are included on a number of rating scales used in the diagnostic procedure, such as the Conner's Parents Rating Scale (Corkum et al., 1998). It has been recognised for some time that the core symptoms of ADHD are also characteristic of sleep deprivation (Kleitman, 1965). Investigators have shown that when sleep disorders are correctly identified and treated in children diagnosed with ADHD, symptoms of ADHD may reverse. Even in cases where ADHD symptoms are not wholly attributable to a primary sleep disorder, better sleep may lead to significant daytime improvements (Dahl, Pelham, & Weirson, 1991). Many of the earlier studies investigating sleep problems in ADHD children relied upon subjective parental reports of children's sleep. Parents of ADHD children have been shown to report significantly more sleep problems for their child when compared with parents of controls. Importantly, however, objective measurement using polysomnography has often failed to confirm these reports (Bonnie, Kaplan, McNicol, Conte & Moghadam, 1987).

Actigraphy has become popular as it permits objective measurement in a naturalistic setting over an extended period of time. The actigraph is based on a miniaturised acceleration sensor that translates physical motion into a numeric representation. This monitoring system is the size of a digital wristwatch and is attached to the wrist (or ankle) of an individual for prolonged periods of time, providing continuous activity data with little interference imposed on the subject (Sadeh et al., 1995). Few studies have used this technique with ADHD children. Dagan et al. (1997) used actigraphy to compare the sleep of 12 ADHD children (aged 6-12years) with normal matched controls. Findings

from this study indicate that ADHD children have poorer sleep quality, that is, lower sleep efficiency (percentage of sleep from sleep onset to time of waking) and higher activity during sleep when compared with controls. They also observed that the sleep quality of the two groups differed over the course of the night. A linear decrease in the sleep quality of controls was observed; a finding that was predictable and expected. However, an unexpected downward trend in sleep quality of ADHD children was noted at the beginning of the night, followed by an upward trend in the third and fourth night-quarters. Although the difference was not significant, it warrants further investigation. Previous studies using polysomnography have failed to demonstrate sleep architectural difference (i.e. sleep stage differences) between these groups. Dagan et al. postulate that if children with ADHD suffer from poor sleep quality, perhaps poor sleep quality is responsible for their behavioural characteristics, i.e. they become very active during daytime in an effort to overcome tiredness. They also suggest an alternative hypothesis that ADHD children may have higher levels of activity both during the day as well as at night due to a yet unknown psychological or neurological cause.

Few studies can be found which measure daytime activity in ADHD children. A recent study by Pinto & Tryon (1996) used an electronic step counter to compare activity levels in a large sample of ADHD boys (n=29; aged 6-12 years). They found that, in both structured and unstructured situations, hyperactive children were more active than normal children. Prior to this, a study by Porrino et al. (1983) using actigraphy in a sample of 12 ADHD boys, also aged 6-12years, measured activity across the day and during sleep. Findings indicated that ADHD children were significantly more active than controls regardless of the time of day including during sleep and on weekends.

Little investigation has taken place with younger hyperactive children. Kaplan et al. (1987) investigated sleep problems in 25 preschool ADHD children using subjective measures and found evidence of increased night waking in ADHD children when compared to normal controls. There appear to be no studies using objective measurements to investigate activity and sleep in this age group, despite the evidence that these children are more likely to exhibit hyperactivity than older children with ADHD.

AIMS AND HYPOTHESES

The purpose of the proposed study is to compare the nature of sleep and activity across 2 samples of children; namely, preschool children who have been diagnosed with ADHD by clinicians at child centres, and normal age and sex matched controls. Objective measures of sleep and activity will be obtained using the wrist actigraph. It is considered that data collection by this method will be clinically and ecologically more valid than the use of either subjective parental reports or polysomnography. Parents have been found to over report sleep problems in children with ADHD and actigraphy has an advantage over polysomnography in that it permits objective measurement within the child's natural environment. Comparisons with normal age and sex matched controls will be made.

This study raises three hypotheses and one research question. Hypothesis 1 is largely confirmatory of the diagnosis of ADHD; Hypotheses 2 and 3 are the main experimental hypotheses.

Hypotheses

1. Preschool children with ADHD will exhibit greater levels of activity during daytime when compared with matched controls.

2. Preschool children with ADHD will exhibit greater levels of activity during sleep (measured by the total and mean activity scores) when compared with matched controls.

3. A difference will be detected in the sleep quality of children with ADHD, defined by the following sleep parameters; sleep efficiency (SE) using measurement of actual sleep time percentage, number and length of night wakening, sleep onset latency (SOL) and total sleep time, when compared with matched controls.

Research Question

Following the findings from the Dagan et al. (1997) study:-

1. Does a difference exist between the sleep pattern of preschool children with ADHD, measured by mean activity scores for night thirds over three consecutive nights, and matched controls?

PLAN OF INVESTIGATION

Subjects

Sample Size

An estimate of the sample size requirement based on the paper by Porrino et al. (1983), the closest equivalent to the present study, indicated that a minimum of 10 subjects in

each group is required to demonstrate a significant ($p<0.01$) between groups main effect (one-tailed) for activity at 0.9 level of power. Due to the slight variation in design of these studies it is considered that a sample size of 20 in each group would be satisfactory.

Approximately 20 untreated ADHD subjects will be recruited from ADHD treatment waiting lists. Recruitment will take place at three localities: The Royal Hospital for Sick Children, Glasgow (hospital outpatient psychiatry department and community psychology sites), and, the Panda Centre, Child Development Assessment Centre, Hawkhead Hospital, Paisley. Following an initial contact with a child specialist, parents of preschool children fulfilling ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder will be provided with an information sheet about the study and invited to participate (Appendix 3.2). All subjects will be between the ages 3 and 5 years old. Patients who do not meet the research criteria will be excluded from the study.

Exclusion Criteria

1. Children who are currently taking medication for ADHD or other medication known to affect sleep or activity.
2. Children who have ADHD as a secondary diagnosis to an another disorder.
3. Children with significant developmental, medical or psychological disorders or intellectual disability.
4. Children who have previously received treatment for ADHD.

Matched control subjects (n=20) will be accessed through each of the subjects participating in the study. Parents of children with ADHD will be asked to volunteer a

child of the same age (within 12 months) and gender as their own child for inclusion in the study. Parents of these children will then be contacted by telephone and invited to participate in the study. Where age and sex matched controls are unable to be accessed in this way, additional control children, matched in the same way, will be recruited from a nursery. Children identified as controls who fulfil any of the above exclusion criteria will be eliminated from the study. Listed below are additional exclusion criteria for matched controls.

Additional Exclusion Criteria for Matched Controls

1. Children who fulfil ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder.
2. Children who have a recognised sleep disorders.

MEASURES

Screening and Intake Measures

1. ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder will be used as an initial screening instrument by psychologists / psychiatrists working at the recruitment sites for eligibility for inclusion. These Criteria will also be utilised as a telephone-screening instrument for control children. (Appendix 3.3)

2. Conners Parent Rating Scale-Revised (S) and the Conners Teacher Rating Scale-Revised (S) (Conners, 1997) will be utilised to support the diagnosis. The parental rating scale will be completed during the assessment interview with the parent and child. The teacher rating scale will be posted to the child's nursery

teacher for completion along with a stamped addressed envelope for ease of return.

3. The Preschool Behaviour Checklist (McGuire & Richman, 1988) will also be posted to the child's nursery teacher for completion and return. This will be used to describe emotional and behavioural problems in the sample.

4. An adapted version of the Parent's Assessment of Children's Symptoms (Taylor, Schachar, Thorley & Weiselberg, 1986)) will be completed during the initial interview to gather demographic information, gain a developmental history of the child and a history of the presenting problem. This will aid the screening process. (Appendix 3.1)

5. The Wechsler Preschool and Primary Intelligence Scale- Revised (WPPSI-R) will be used to assess the intellectual status of children where there is a query of developmental delay or learning disability.

Objective Assessment of Activity and Sleep

Activity will be assessed objectively using actigraphic recordings. The Actigraph utilises an accelerometer to monitor the occurrence and degree of motion. This sensor integrates the degree and speed of motion to produce activity counts which are then stored. The actigraphs being utilised are Actiwatch-R Model AW2 and were developed by Cambridge Neurotechnology Ltd. The corresponding software package containing Rhythmwatch® and Sleepwatch® will be used to organise and analyse the data.

The Actigraph resembles a small wristwatch and will be attached to the non-dominant wrist of subjects. It will be worn continuously for a period of 3 days and nights. Although waterproof, parents will be advised to remove the watch from their child's wrist for bathing and swimming. This model of actigraph has an event marker which, when depressed, marks the date and time. The actigraph differentiates between sleep and wake periods based upon the amount of movement in the limbs. Data will be collected using a sampling epoch of 1 minute. The Sleepwatch® programme algorithms allow for the calculation of sleep-wake parameters.

Subjective Measure of Sleep

The subjective measurement of sleep will be obtained using an adapted version of the Sleep Diary (Espie, 1991). This will be completed by a parent for the duration of the recording period. The diary will provide a summary record of sleep parameters (Appendix 3.4).

DESIGN

The proposed design is primarily a between group comparison of independent samples. Investigation will take place to consider possible significant differences in activity and sleep parameters between the experimental and control group. A within subject comparison of sleep measures and activity will also investigate differences across the 3 nights of recording.

PROCEDURE

Clinicians working at the recruitment sites will identify potential subjects for inclusion in the study. Following an initial contact with a clinician (psychologist / psychiatrist / paediatrician), and, provided the ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder are met, parents will be informed of the study and invited to participate. Arrangements will be made to conduct an assessment at the clinic site with the parent and child. The interview will be of structured format and involve gathering information on the child's developmental history, sleep history, and history of ADHD. This will permit additional screening. Providing Criteria for inclusion are met, parents will be invited to participate further with the research. Following informed parental consent (Appendix 3.5), each child will be provided with an actigraph, attached to the non-dominant wrist. Instructions will be provided for correct use of the actigraph. Parents of all participants will be asked to complete a sleep diary for their child over the three nights of recording. Parents of subjects will be asked to volunteer a child of the same sex and similar age, where possible, as a control for their child. Additional controls will be accessed from a children's nursery where necessary. Parents of control children will be contacted by telephone, and, following a brief telephone-screening interview, invited for assessment. Control children will then undergo the same procedure as the experimental group. Nursery teachers of all subjects will be contacted by post and asked to participate with the study by completing two questionnaires (Conners Teacher Rating Scale and the Preschool Behaviour Checklist). Stamped addressed envelopes will be enclosed to encourage return of questionnaires. Parents will be asked to return the actigraph and questionnaires after completion of the recording. Feedback on ADHD subjects will be provided to clinicians at the recruitment sites. This may contain information useful for

guiding clinical assessment and intervention.

SETTINGS AND EQUIPMENT

Recruitment and interviewing of subjects will occur at three child outpatient sites. The Royal Hospital for Sick Children, Glasgow will provide two recruitment sites; the Department of Child and Adolescent Psychiatry, Dr Barton's outpatient clinic, subjects will also be recruited from the community service attached to the Department of Child and Family Psychology, provided by Ms Butler and colleagues. The third recruitment site will be at Dr Cheriyan's outpatient clinic (Consultant Paediatrician) at the Panda Centre, Child Development Assessment Centre, Hawkhead Hospital, Paisley

The equipment that will be utilised is the aforementioned questionnaires and Actigraph. Six actigraphs will be loaned from the Department of Psychological Medicine, University of Glasgow. Sleepwatch® and Rhythmwatch®, computer analysis programmes devised by Cambridge Neurotechnology Ltd, will collate and analyse the actigraphic data. If required, the Wechsler Preschool and Primary Scale for Intelligence will be borrowed from The Royal Hospital for Sick Children's Child and Family Psychology Department or Hawkhead Child and Family Centre.

DATA ANALYSIS

Data for each subject will be coded to ensure confidentiality and will be stored appropriately. Actigraphic data will be downloaded to the data storage and analysis programme. Actigraphic data will be transferred into SPSS for Windows spreadsheets for statistical analysis.

A t-test for independent samples will be used to compare the scores of the two groups on the various questionnaires (Detailed in Settings and Equipment section).

Data Analysis /Hypothesis 1

Comparison of mean daytime activity scores between experimental and control groups will be achieved using a using a repeated measures ANOVA (2x3).

Data Analysis /Hypothesis 2

Comparison of control and experimental group activity during sleep (mean activity scores) will be achieved using a repeated measures ANOVA (2x3).

Data Analysis /Hypothesis 3

Repeated measures ANOVA's (2x3) will be computed to test for differences between the control and experimental group for each of the sleep variables.

Data Analysis/Research Question

To compare the sleep pattern (using measurements of mean activity score) of groups (experimental and control) during night thirds, over 3 nights of recording, a factorial ANOVA (2x3x3) nested design will be required.

PRACTICAL APPLICATIONS

The preschool hyperactive child has largely escaped investigation to date. It is hoped that this research will contribute to a greater understanding of the nature activity and sleep in this population. This may provide practical implications for assessment and treatment,

including early intervention.

TIMESCALES

April 1999	Proposal will be submitted for ethical approval.
June 1999- May 2000	Data collection phase and completion of a full literature review.
June 2000	Data analysis and draft of project write-up.

ETHICAL APPROVAL

An ethics application based on this proposal will be submitted for consideration to both Yorkhill NHS Trust and Argyll and Clyde Health Board during April 1999.

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AMMENDMENTS TO THE RESEARCH PROPOSAL

Recruitment

1) As a result of difficulties with recruitment of subjects, recruitment was extended to include Ayrshire child psychology and psychiatry services. Ethical approval was sought from Ayrshire and Arran Primary Care NHS Trust and granted in December 1999. Recruitment of subjects took place at Ayrshire Central Hospital, the base for child psychology and psychiatry services in Ayrshire.

2) The procedure for recruitment of controls was altered to conform to Yorkhill Ethics Committee guidelines. Controls were not accessed via subjects; rather, all controls were gathered from two local nursery establishments; Sandyford Day Nursery and Sandy Road Nursery both located in Glasgow.

Sample Size

An estimate of the sample size requirement based on the paper by Porrino et al. (1983), the closest equivalent to the present study, indicated that a minimum of 10 subjects in each group would be required to demonstrate a significant ($p<0.01$) between groups main effect (one-tailed) for activity at 0.9 level of power. However, due to the slight variation in design of these studies a sample size of 20 in each group was sought. Following the aforementioned recruitment difficulties, only 14 subjects could be found who fulfilled inclusion criteria, 2 of whom had to be excluded due to actigraphic recording difficulties.

Screening Instruments

1) It was proposed that ICD-10 would be used as a telephone-screening instrument

with controls. However as all controls were recruited from nursery sites it became practical to integrate ICD-10 screening into the assessment interview conducted at the nursery sites.

2) The revised long forms of both the Conners' Parent and Conners' Teacher Rating scales were preferred for use to the short forms due to their inclusion of a DSM-IV diagnostic scale for ADHD.

Alterations to Data Analysis

Data Analysis / Hypothesis 1

Rather than comparing mean activity scores for days across 3 days of recording, a finer analysis of daytime activity patterns was preferred. This was achieved by separating daytime into three sections of equal duration (approximately 3-4 hours) and calculating the mean activity scores for each section. A between group comparison of mean activity scores in day sections across the three days of recording was achieved using a factorial ANOVA (2x3x3) nested design.

Ethical Approval

Ethical approval (Appendix 3.6) was granted from Argyll & Clyde Primary Care NHS Trust (5th May, 1999), Yorkhill NHS Trust (1st August, 1999), and Ayrshire & Arran Primary Care NHS Trust (23rd December, 1999).

4. Major Research Paper

Preschool Children with Attention Deficit Hyperactivity Disorder - A Naturalistic Assessment of Activity and Sleep.

Prepared in accordance with notes for contributors for:

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Abstract

Researchers and clinicians in the field of Attention Deficit Hyperactivity Disorder have recognised the importance of sleep problems in children with ADHD. However, little is known about the circadian rest-activity pattern of the preschool child with ADHD. This study investigated the nature of sleep and activity in a sample of 12 preschool children fulfilling diagnostic criteria for ADHD relative to age and gender matched controls using both objective and subjective measurements. Results indicated that parents of ADHD children reported significant daytime over-activity and sleep disruption in their children. Objective evaluation using actigraphy failed to detect differences in daytime activity between the ADHD group and their matched controls. ADHD children were found to be more active during sleep than their comparisons; however, this was only apparent in a sub-set of ADHD children. No significant difference was found in sleep pattern or sleep quality parameters between the groups. There was high variability both between and within groups in activity and sleep measures and objective evaluation of activity and sleep failed to consistently differentiate children diagnosed with ADHD from controls. Various explanations are provided to account for these findings and implications for future research are discussed.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is the most common neurobehavioural disorder of childhood, affecting the span of development even continuing into adult life (Shaywitz, Fletcher & Shaywitz, 1997). Core symptoms are essentially behavioural characteristics i.e. inattention, hyperactivity and poor impulse control. DSM-IV provides the most widely recognised diagnostic criteria, however, the diagnosis of ADHD continues to evoke considerable debate. This may, in part, be due to the fact that symptoms diagnostic of ADHD manifest a developmental trend, for example, until the age of 3 years activity levels increase but then follow a downward trend so that by adolescence gross motor hyperactivity is no longer present. Not only do symptoms of ADHD alter with time, they exhibit situational variability. Difficulty with diagnosis has confounded prevalence estimates. Recent literature suggest a prevalence rates of between 3 and 9% in school-aged children (Teicher, 1995) with a male/female ratio of 4:1 (SIGN, 1999). Disorders of hyperactivity arise early in development, usually within the first five years of life. Constitutional abnormalities are thought to play a crucial role in the genesis of this disorder but knowledge of specific aetiology is presently lacking. ADHD is believed to involve complex interactions between biology and the environment.

Sleep problems are a common manifestation of ADHD and are included on a number of rating scales used in the diagnostic procedure. It has been recognised for some time that the core symptoms of ADHD are also characteristic of sleep deprivation (Kleitman, 1965). Investigators have shown that when sleep disorders are correctly identified and treated in children diagnosed with ADHD, symptoms of ADHD may reverse. Even in cases where ADHD symptoms are not wholly attributable to a primary sleep disorder,

better sleep may lead to significant daytime improvements (Dahl, Pelham, & Weirson, 1991). Many of the earlier studies investigating sleep problems in ADHD children relied upon subjective parental reports of children's sleep. Parents of ADHD children have been shown to report significantly more sleep problems for their child when compared with parents of controls. Importantly, however, objective measurement using polysomnography has often failed to confirm these reports (Kaplan, McNicol, Conte, & Moghadam 1987).

Given the relationship between the mechanisms governing arousal and sleep, several lines of theoretical investigation have centred around this area. Early theories of arousal resulted in two quite opposite explanations for ADHD being advanced. One theory hypothesised that ADHD was the result of hypoarousal (Zentall, 1977) whilst the other advocated hyperarousal as causal of this difficulty (Strauss & Lehtinen, 1947). Neither theory, despite continuing investigation in the intervening years, could be accepted due to inconclusive findings. However, more recently an alternative arousal theory has been postulated; ADHD is caused by a deficit in the control of arousal levels in relation to environmental requirements. (Douglas, 1984, 1985). This theory infers that differences found in the sleep and daytime activity of ADHD children, when compared to normal controls, are due to rapid oscillations in arousal levels during wakefulness and sleep. It is suggested that this is the result of a deficit in the control of neurophysiological arousal. Some evidence has been found to support this theory (Ramos Platon, Bueno, Sierra & Kales ,1990), however further research is required for it's validation. Other researchers hold that sleep may play a more central role in the genesis of ADHD (Dagan et al., 1997). It has been suggested that if children with ADHD suffer from poor sleep quality,

perhaps poor sleep quality is responsible for their behavioural characteristics, i.e. they become very active during daytime in an effort to overcome tiredness. Alternatively, ADHD children may exhibit higher levels of activity both during the day as well as at night might be due to a yet unknown psychological or neurological cause.

Actigraphy has become popular as it permits objective measurement in a naturalistic setting over an extended period of time. The actigraph is based on a miniaturised acceleration sensor that translates physical motion into a numeric representation. This monitoring system is the size of a digital wristwatch and is attached to the wrist (or ankle) of an individual for prolonged periods of time, providing continuous activity data with little interference imposed on the subject (Sadeh, Hauri, Kripke, & Lavie, 1995). Few studies have used this technique with ADHD children. Dagan et al. (1997) used actigraphy to compare the sleep of 12 ADHD children (aged 6-12years) with normal matched controls. Findings from this study indicated that ADHD children have poorer sleep quality, that is, lower sleep efficiency (percentage of sleep from sleep onset to time of waking) and higher activity during sleep when compared with controls. They also observed that the sleep quality of the two groups differed over the course of the night. A linear decrease in the sleep quality of controls was observed, a finding that was predictable and expected. However, an unexpected downward trend in sleep quality of ADHD children was noted at the beginning of the night, followed by an upward trend in the third and fourth night-quarters. Although this finding was not significant, it warrants further investigation. Previous studies using polysomnography have failed to demonstrate consistent sleep architectural differences (i.e. sleep stage differences) between these groups (reviewed in Inglis, 2000).

Few studies can be found which measure daytime activity in ADHD children. Altered locomotor activity is considered a cardinal sign for ADHD and numerous attempts have been made to develop objective measures to demonstrate that children with ADHD are in fact hyperactive. Early research yielded ambiguous findings and this was thought to be due to the variability in the measurement techniques utilised (Barkley & Ulman, 1975). A recent study by Pinto & Tryon (1996) used an electronic step counter to compare activity levels in a large sample of ADHD boys (n=29; aged 6-12 years). They found that in both structured and unstructured situations, hyperactive children were more active than normal children. Prior to this, a study by Porrino et al. (1983) using actigraphy in a sample of 12 ADHD boys, also aged 6-12years, measured truncal activity across the day and during sleep. Findings indicated that ADHD children were generally more active than controls regardless of the time of day including during sleep and on weekends. An exception to this was found during free-play at school where an increase in activity was noted for both ADHD and control groups but did not differ significantly between groups. However, ADHD children were found to be more active during weekends and nights than their comparisons. Consistently, less support can be found for overactivity during free-play situations (Kaspar, Millichap, Backus, Child & Schulman, 1971) and, therefore, motor excess in ADHD is often treated qualitatively because it is thought to occur primarily under highly structured situations where attentional demands are high.

Little investigation has taken place with younger hyperactive children. Kaplan, McNicol, Conte, & Moghadam (1987) investigated sleep problems in 25 preschool ADHD children using subjective measures and found evidence of increased night waking in ADHD children when compared to normal controls. There appear to be no studies using

objective measurements to investigate activity and sleep in this age group, in spite of the evidence that these children are more likely to exhibit hyperactivity than older children with ADHD (Shaywitz, Fletcher & Shaywitz, 1997). The purpose, therefore, of this study was to investigate the nature of sleep and activity in a sample of preschool children with ADHD using both subjective and objective measurement. Activity and sleep was measured by continuous actigraphic monitoring over a 72-hour period as well as being subject to parental report. Age and gender matched controls were used for comparison. It was hypothesised that preschool children with ADHD would exhibit greater levels of activity during daytime and sleep when compared with matched controls. It was further hypothesised that differences would be detected in the sleep quality between the two groups in terms of actual sleep time and actual wake time during the night, number and length of night wakenings, sleep onset latency (SOL) and sleep efficiency. Additionally, by separating each night of sleep into three sections (night thirds) and comparing the activity scores in these sections, differences that existed in sleep pattern between the ADHD children and matched controls would be detected.

Method

Participants

ADHD preschool children between the ages of 3 to 5 years were recruited from child clinical psychology, psychiatry and development services across North Ayrshire, Glasgow and Renfrewshire. All children were recruited following a referral to specialist child services and before any treatment for their difficulty commenced. Children were selected for suitability by a child specialist working in the various settings and referred for inclusion in the study. Inclusion criteria for ADHD subjects were (1) fulfilment of

ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder (2) a Conners' Parent Rating Scale Revised long form (CPRS: RL) (Conners, 1997) ADHD Index T-Score of greater than 70 (≥98 percentile) indicating a significant problem (markedly atypical) (3) fulfilment of DSM-IV Attention-Deficit/Hyperactivity Disorder predominantly hyperactive-impulsive type from the CPRS:RL (>6 symptoms). Excluded from the study were (1) children who were taking medication for ADHD or other medication known to affect sleep or activity. (2) children who had ADHD as a secondary diagnosis to an another disorder (3) children with significant developmental, medical or psychological disorders or intellectual disability (4) children who had previously received treatment for ADHD.

Fourteen children met the criteria and were included in the study, 12 boys and 2 girls. Of these, two male children had to be excluded due to actigraphic recording difficulties. Controls matched for age (within 6 months) and gender were recruited from local nursery schools. Controls were excluded if they (1) fulfilled either ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder or DSM-IV Attention-Deficit/Hyperactivity Disorder predominantly hyperactive-impulsive type from the CPRS: RL or CTRS: RL (2) had a recognised sleep disorder (3) had significant developmental, medical or psychological disorders or intellectual disability (4) were taking medication known to affect sleep or activity. Attempts were made to control for daytime activity by matching, where possible, nursery attendance. Controls were recruited simultaneously with subjects to alleviate any possible seasonal variations in activity levels. One additional control was excluded due to elevated scores on the CTRS: RL.

When there was any suggestion of significant developmental or intellectual delay it was intended that the Wechsler Preschool and Primary Intelligence Scale- Revised (WPPSI-R) would be used to assess the intellectual status of these children. However, this proved to be unnecessary, perhaps due the initial screening for suitability by child specialists before referral. Nevertheless, parental concern over delayed speech development was evident of 6 of the ADHD sample and 2 of the controls. Interestingly, nursery staff did not always hold these concerns, and, no children included in the study had poor articulation (CBCL no 8), although speech was considered 'sometimes not clear' in 2 controls and 3 of the subjects.

Subjects were matched for gender and age [t (22)= 0.43, p=0.67]. All children resided with their natural mothers; 9 of the ADHD children lived with 2 parents compared with 5 of controls. The two groups of children were drawn from similar family sizes [t (2) = 2.0, p=0.06] and no difference between paternal employment status was found between the two groups [χ^2 (2)=1.39, p=0.50]. However, significantly more mothers of control children were working compared with mothers of ADHD children [χ^2 (2)=11.40, p=0.03]. In spite of attempts made to match nursery attendance, children in the control group spent on average over twice as many hours at nursery each week (mean 31.17 hours) than did ADHD children (mean 14.06 hrs), this difference was highly significant [t (22)=-4,29, p< 0.01]. This difference may be accounted for, in part, by the fact that 9 of the 12 control children's mothers worked and an additional 2 were in further education, whereas, only 3 of the ADHD mothers worked, none of whom were students. Also, a few of the ADHD children had been restricted in the number of hours they could attend nursery due to problematic behaviour, one child had been excluded from nursery

altogether for this reason. Lastly, a difference also emerged between the two groups in the presence of current or past depression where significantly more mothers of ADHD children reported a history of depression [χ^2 (1)=4.20, p=0.04].

Measures

ICD-10 Research Diagnostic Criteria for Hyperkinetic Disorder were used as an initial screening instrument (Appendix 3.3). The Conners' Parent Rating Scale-revised, long form (Conners, 1997) was utilised to support an ADHD diagnosis. This scale contains 80 items where severity of difficulties are rated on a four point scale from 'not at all true' to 'very much true'. The long version of both the Conners' Teachers and Conners' Parents Rating Scales were utilised as these incorporate a DSM-IV diagnostic scale for Attention-Deficit/Hyperactivity Disorder, predominantly hyperactive-impulsive type. Teachers ratings of behavioural and emotional development were also obtained using the Conners' Teacher Rating Scale-Revised long form (CTRS: RL). This rating scale contains 59 items and contains the same subscales as the CPRS: RL with the exception of the psychosomatic subscale that is only on the long form for parents. A shortened and adapted version of the Parent's Assessment of Children's Symptoms (Taylor, Schachar, Thorley, & Weiselberg, 1986) was completed as part of the structured interview to gather demographic information and take a developmental and medical history of the child (Appendix 3.1). Included in this was information on the child's sleep. Parents were asked to estimate the duration of their child's sleep, report routine bedtime and rising times and rate on a 4 point scale the frequency of difficulties with setting, waking during the night, nightmares and night terrors and parasomnias. Daytime napping was also recorded. Parents were asked to rate their child's sleep problem and the extent to which they

believe this interfered with daytime functioning. The Preschool Behaviour Checklist (McGuire & Richman, 1988) is designed for the early identification of difficult behaviour in young children and includes questions related to the child's emotional development, the presence of conduct problems, concentration and constructive play, social relations, and development. The 22-item checklist is scored by nursery teachers for frequency and severity of behaviours. A score of greater than or equal to 12 is indicative of behaviour problems that require further attention. This was utilised to provide a more global measure of the children's behaviour at nursery.

Objective Measurement of Sleep

Activity was objectively measured using an ambulatory actigraphic procedure. The actigraph utilises an accelerometer to monitor the occurrence and degree of motion. This sensor integrates the degree and speed of motion to produce activity counts that are recorded. The validity of actigraphy in terms of it's ability to distinguish between sleep and wakefulness and it's ability to provide a reliable measure of sleep-wake organisation and sleep quality has been demonstrated by studies covering a wide range of age groups, including normal and clinical samples (see Sadeh et al, 1995 for a detailed review). All studies are based upon drawing comparisons between actigraphy and polysomnography (used as the gold standard measurement). Minute-by-minute agreement between actigraphic and polysomnographic scoring was found to be 89.9 % for a sample of children (Sadeh et al, 1991). The actigraphs used were Actiwatch-R Model AW2, developed by Cambridge Neurotechnology Ltd. The corresponding software package Sleepwatch® was used to organise and analyse the data. The Sleepwatch® programme algorithms allow for the calculation of sleep-wake parameters. The actigraph

differentiates between sleep and wake periods based upon the amount of movement in the limbs. Actigraphs are programmed with a calibration coefficient to normalise data between watches to remove most of the variation between units due to sensors. The reliability of recording between units (watches) is reported by the manufacturer to reach an agreement level of 96%. Data were collected using a sampling epoch of 1 minute. The six actigraphs used were randomly assigned to subjects and controls. The actigraph, resembling a small wristwatch, was attached to the non-dominant wrist of subjects and controls. Although waterproof, parents were advised to remove the watch from their child's wrist for swimming. Recording took place during weekdays when the children attended nursery. The measured parameters were bed time, rising time, time in bed, actual sleep time, sleep efficiency, total and mean activity scores, number of naps, and number of episodes of wakefulness.

Subjective Measure of Sleep

The subjective measurement of sleep was obtained using an adapted version of the Sleep Diary (Espie, 1991). The diary provided a summary record of sleep parameters (Appendix 3.4). Included in this was a recording of the occurrence and duration of daytime napping as well as time spent each day in nursery. This was completed by a parent- upon the child rising from bed -for the duration of the recording period.

Procedure

Following initial contact with a senior clinician (psychologist / psychiatrist / paediatrician) at one of the recruitment sites, parents of children judged suitable for inclusion were informed of the study and invited to participate (Appendix 3.2). The

researcher conducted all interviews with parents of subjects and controls. Assessment interviews occurred at clinic sites with both parent(s) and child attending. Providing the criteria for inclusion were met, parents were invited to participate further with the research. Following parental consent to the child's involvement being gained (Appendix 3.5), each child was provided with an actigraph and parents were advised to strap this to the child's non-dominant wrist. The actigraph was to be worn continuously over a 72-hour recording period. Instructions were provided for correct use of the actigraph (Appendix 4.1). Parents were also asked to complete a daily diary of their child's sleep over the three days and nights of recording, including an estimation of the time spent in nursery each day and of times when the actigraph was removed.

After a subject had been recruited, nursery staff from local children's nursery schools identified a matched control. Parents of control children were contacted initially by nursery staff and provided with information about the study. Those parents who showed interest in participating were informed that they would be contacted by the researcher and invited for an assessment. Control children underwent the same procedure as the experimental group. Nursery teachers of all participants were asked to assist with the study by completing two questionnaires (Conners' Teacher Rating Scale and the Preschool Behaviour Checklist). Stamped addressed envelopes were enclosed to encourage return of questionnaires. Parents were asked to return the actigraph and diary sheet after completion of the recording.

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insert table 1 here

Results

Group Differences in Daytime Activity

As can be seen in table 1, parents and teachers reported ADHD children as being more active during the day, as assessed by the DSM-IV hyperactive-impulsive t-scores of the CPRS: RL and CTRS: RL (both $p<0.001$) than the matched control group. The groups differed significantly on reported ICD-10 activity symptoms where all ADHD children were scored at the maximum level ($p<0.001$). Teachers also reported the ADHD group to exhibit significantly more behavioural problems at nursery ($p=0.006$) when compared with controls.

Analysis of the objective measurement of daytime activity was achieved using a factorial ANOVA nested design with one between factor (subject type) and two within factors (day and section of the day; section of day nested within day). Daytime was divided evenly into three sections of equal duration (approximately 3-4 hours), where section 1 followed the child rising from bed, section 2 comprised of recordings during afternoons and section 3 of late afternoon and early evening recordings. Mean activity scores (at 1-hour sampling epochs) for the three sections of each day over the three days of recording for both groups were compared. No difference in daytime activity was found (a) between groups [$F(1, 198)=2.02$, $p=0.16$]; (b) between days [$F(2, 198)= 2.53$, $p= 0.08$], or; (c) between sections of the day [$F(6, 198) = 0.81$, $p=0.57$]. There were no significant interaction effects for day by group [$F(2, 198) = 1.71$. $p=0.18$], or session (day) by group

[F (6, 198), p= 0.5]. Diurnal patterns of activity are demonstrated in Figure 1 and confirm a similar pattern of daytime activity for the ADHD group and control group. Some differences were noted. From the graph it appears consistently that the ADHD group's peak activity scores were higher than that of the control group. In addition, ADHD children appeared to be more active than controls in the evening, taking longer to settle before sleep (8-11pm). The control group is observed to have reduced activity levels at noon each day, this is likely due to the structure imposed by nursery during lunchtime. Therefore, although diurnal differences exist, no global difference in daytime activity was found to be significant. A significant discrepancy was apparent between subjective and objective evaluations of activity in the ADHD sample where parents and teachers reported significant over-activity in these children and objective measurement failed to demonstrate this.

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insert figure 1 here

Parental recording of daytime napping for the three days of recording was also examined. Parents of the ADHD group proved poor at completing daily diaries, many diaries contained missing information, 2 were returned unfilled. This resulted in fewer numbers for comparison in the analysis. A repeated measures ANOVA (2x3) revealed no difference between groups [F (I, 20) = 0.48, p=0.50] or across days [F (2,40) = 1.55, p=0.22], in the number of naps reported. Day by group interaction effect was not significant [F (2,40) = 0.10, p=0.91]. Similarly, no difference was found in parental

recording of the duration of daytime naps between groups [F (1,20)= 1.69, p=0.21] or across days [F (2,40) =0.28, p=0.75]. Again there was no significant interaction effect of day by group [F (2) = 0.12, p= 0.89]. Nap Analysis, a function of the Sleepwatch® programme, was utilised where sensitivity was set at a minimum of 10 minutes for recording the presence of a nap. Repeated-measures ANOVA's (2 x 3) were computed for the number of naps and nap duration measured by actigraphy. Results indicate no significant difference in number of naps for group [F (1,22)= 1.44, p=0.24], and days [F (2,44) = 2.37, P=0.11], with no significant interaction effect of group by day [F (2) = 2.94, p=0.63]. Duration of naptime also failed to differ between groups [F (2, 22)= 1.14, p=0.30], and between days [F (2, 44)= 1.86, p=0.17] and, again there was no interaction effect of group by day [F (2)= 1.95, p=0.16]. Means for nap duration and number of naps were calculated for the three days for both parental diary recording and actigraphic measurement. The mean nap duration for those participant who napped was 49 minutes and 21minutes respectively for the parental diary (n=9) and actigraphy (n =11). Mean number of naps recorded across groups on the parental diary was 1.0 and by actigraphy 1.75. T-tests for paired samples were carried out to detect any difference between to two recording techniques. Actigraphic recording proved more sensitive at recording the presence of naps recording significantly more naps [t (21)= 2.33, p=0.03] when compared with the parental diary and also revealed significantly shorter nap duration [t (21)= 2.34, p= 0.03].

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insert figure 2 here

Group Difference in Activity during Sleep

The pattern of preschool children's sleep over the course of the night was examined using actigraphic information. Similar to the daytime analysis, nights were divided into three sections of equal time (approximately 3 hours) and mean activity scores (at 1 minute epochs) for each section were compared. Mean activity scores are the average activity scores in all epochs within the analysis period. This was computed by Sleepwatch® and is the total activity score divided by the number of analysed epochs and, therefore, controls for differing lengths of sleep duration. Wake periods during the night of greater than 10 minutes were excluded from this analysis. Analysis was achieved using a factorial ANOVA nested design with one between factor (subject type) and two within factors (night and night section; night section nested within night). Analysis revealed a main effect of group; mean activity scores for ADHD children were significantly higher than controls [F (1, 198)= 4.1, p=0.04]. No difference was detected across the three nights of recording [F (2, 198)= 0.03, p=0.97]. There was no significant interaction effect of group by section [F(6, 198) = 1.26, p=0.28] or group by night [F (2, 198)= 1.75, p=0.18]. However, a significant difference between night sections (independent of groups) was revealed [F (6, 198)= 2.25, p=0.04]. Post hoc analysis of the night section data was achieved using paired sample t-tests. As no difference between nights had been found, the first night was selected for this analysis. The Bonferroni method was used to correct the level of significance for multiple comparisons, this determined 0.017 as the criterion for significance. Significant differences were discovered between the first two sections of the night [t (23)=-3.79, p=0.01] and the first and third sections [t(23)=-3.64, p=0.01]; no difference was found between the second and third sections [t(23)=-0.03, p=0.98]. Figure 2 plots group mean activity scores for the 3

night sections. As can be seen, the ADHD group exhibited more activity overall when compared with controls; this difference was most obvious during the first third of the night. However, both groups showed increased activity during the second section and this level of activity was maintained during the third section.

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insert figure 3 here

A paired comparison of subjects' mean activity scores across the three nights is shown in figure 3. It can be seen that six of the ADHD sample exhibited more activity than their control comparison across the three nights of recording; two of whom seemed considerably more active than both controls and other ADHD children. Four of these six children were reported by their parents to have a sleep problem at interview. However, five of the control sample appeared to be more active than their matched ADHD comparison, and one additional pair has similar mean activity scores. Also of note, pair 5 and 12 were matched female pairs and appeared to exhibit less activity overall than their male counterparts.

In sum, preschool children have significantly quieter sleep (less activity exhibited) during the first part of the night. Activity increased during the middle section and this was maintained during the last night section. The pattern of activity during sleep both between and within subject groups seems variable. A main effect of group was found, however, it is possible that the two ADHD children who had greatly elevated activity scores could account for the significant difference found in mean activity scores between

the two groups.

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insert table 2 here

Group Differences in Sleep Quality

At the initial interview, all 12 of the control group children were rated as having 'no sleep problem' by their parents. Conversely, sleep problems were reported in the ADHD group by 7 of the children's parents with 1 child's difficulty rated as 'mild', and, 3 children each being rated as having 'moderate' and 'severe' sleep difficulties. Table 2 displays parental ratings of children's sleep quality difficulties reported at interview. Overall, more sleep disruption was reported in children with ADHD. Of note, 7 of the ADHD group were reported to have frequent settling problems and waking during the night (> 3-4 times each week). Five ADHD children were reported to have bedwetting problems on a nightly basis. Relatively few parents considered sleep disruption to interfere with their child's daytime functioning (3 of the ADHD group).

Table 3 presents the results of the analyses of group differences in key sleep parameters across the 3 nights of recording using both parental diary information and actigraphy. Repeated measures ANOVA's (2 x 3) were utilised for the comparisons. As already stated, many parents of ADHD children proved non-compliant in the completion of the sleep diary which resulted in smaller group comparisons due to missing data. Two of

these parents failed to record any information. Recordings of bedtime and rising time were made by the other 10, however, where estimations of sleep and wake times were required, often these would not be recorded. By comparison, all parents of the control sample completed diaries with only 4 missing entries found for the group across the three nights of recording.

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insert table 3 here

The analyses revealed no group main effects for any sleep parameter measured either by actigraphy or parental diary. Overall, few other differences were found. A group by night interaction was found in the number of wake bouts recorded by actigraphy ($p=0.03$). Post hoc analysis using independent samples t-tests revealed that this was due to significant differences in the number of wake bouts between groups (controls having significant less) during the first night of recording [$t(22)= 2.68$, $p=0.014$)]. The Bonferroni method was again used to correct the level of significance to 0.017. A significant difference in parental reports of bedtime was found across nights [$F(2,40)=6.03$, $p=0.05$] as was a group by night interaction for bedtime [$F(2,40)=3.18$, $p=0.03$]. Post hoc analysis using paired samples t-tests were computed and revealed a significant difference in bedtime [$t(21)=-2.77$, $p=0.011$] between night 2 (mean=21.23hrs) and night 3 (mean = 20.56 hrs). Post hoc analysis of the bedtime group by night interaction using independent t-tests failed to reveal a significant difference between groups over nights. However, it is likely that the interaction effect was the result of parents of the ADHD group reporting a later bedtime on the third night (mean =22.0 hours) than parents of controls (mean = 20.58 hours) [$t(20)=1.90$, $p=0.072$].

Differences between the groups in parental report of the time awake after falling to sleep (WASO) and in the number of night awakenings were apparent (see table 3) although found not to be significant. Parents of ADHD children reported the length of night wakening to be approximately three times longer than parents of controls and more than twice as many wakenings during the night. It is likely that analysis failed to find these differences between groups as significant due to substantial variability in parental recordings and missing data that may have caused the analysis to be underpowered.

Interestingly, Parents of ADHD children were found to report that their children go to bed later (on average 47 minutes) and rise earlier (on average 30 minutes) than actual objective measurement demonstrated. As a result, the time taken to fall asleep (SOL) could not accurately be estimated. Parents of controls made fair estimations of bed and rising times. However, ADHD parents proved more accurate at estimating total sleep time when compared to control parents who overestimated this by an average of 81 minutes. This is explained by the finding that parents of children in the control group reported less wakefulness during the night, underestimating this by on average approximately 54 minutes. Parents of ADHD children appeared more sensitive to the occurrence of night wakefulness yet similarly underestimated length of wakefulness.

Using actigraphic data, sleep efficiency scores (the percentage of time actually asleep during time in bed) were analysed using a repeated measures ANOVA with one between group factor (ADHD or control) and one within group factor [night(3)]. No significant difference was found between groups [$F(1,22)=1.16$, $p=0.29$] or within nights [$F(2,44)=0.22$, $p=0.80$] and there was no night by group interaction effect. Mean sleep

efficiency scores for participants over 3 nights fell above 85%. However, this is likely an overestimation for, as already mentioned, SOL could not be reliably computed. Therefore, as SOL remains unknown, the calculation of sleep efficiency was computed from the time just prior (maximum 10 minutes) to sleep initiation. Reports from parental diaries of SOL revealed that parents of ADHD children estimated SOL as being almost twice as long (group mean over three nights of 33 minutes) as controls (17 minutes).

Discussion

The present study sought to record, accurately and objectively, both daytime and night-time activity levels of hyperactive preschool children and controls in their natural environments. The sleep quality of these children was also measured, both subjectively by parental report, and objectively by actigraphy. The main findings are discussed below.

Day Time Activity

Shaywitz and colleagues (1997) reported that activity levels in children with ADHD peak at age 3, following which, a gradual downward trend in gross motor activity is apparent. It was therefore hypothesised that a difference in daytime activity would be apparent between the preschool ADHD children and matched comparisons.

Consistent with previous findings, and consistent with diagnostics, parents and teachers of ADHD children reported significant over-activity in these children. However, contrary to previous findings with older children (Pinto & Tryon, 1996; Porrino et al., 1983), preschool ADHD children were found objectively to exhibit a similar pattern of activity to their matched controls over the course of the day. There are four possible

interpretations of this finding. Firstly, situational factors may make an important contribution. Some studies have found that actigraphic measurements of ankle and wrist movements are higher for ADHD children than normal controls in structured situations but not during free play (Schulman & Cjarinda ,1964; Pope 1970) and a situational specificity hypothesis of ADHD was advanced. In the present study, the ADHD children spent significantly less time at nursery when compared with controls and this may in part account for the findings. It appears that ADHD children find difficulty coping with environments where structure is imposed, and, when in these environments, the behavioural manifestations of ADHD become exaggerated and most obvious. Therefore, ADHD children's lesser attendance at nursery may prove an adaptive parental strategy for reducing problems related to overactivity. Furthermore, in some instances, reduced time at nursery was not due to parental choice but followed exclusion or restricted access to nursery because of the significant behavioural management problems posed by these children.

Secondly, it may be that the preschool nursery environment imposed fewer restrictions on activity than the school environment and was therefore less structured. Exclusion and restricted access to nursery may be due primarily to the presence of behavioural problems and less to motor overactivity. In this case, both the ADHD children and controls in this sample were being observed in situations that were comparable to free-play. There was some evidence to support this notion. Figure 1 demonstrates that activity was greatest approximately between the hours of 9am until 6pm each day, as the average time spent in nursery by controls was in excess of 31 hours each week, control children were at nursery during this time. Also of note, the effect of structure upon activity was

demonstrated in the control sample during lunchtime where activity levels were noted to decrease daily during this time. Therefore, it is suggested for future research that the activity of preschool children with ADHD is compared to that of controls in a highly structure environment; this may make differences in activity more apparent.

The third plausible explanation for the findings is that they are the result of a ceiling effect, where a difference could not be found between the samples in activity due to these children being at a stage developmentally where they are exhibiting peak activity levels. Preschool years are important for the motor skills development and this developmental stage is associated with large muscle activities such as running, jumping, and climbing and rough-and -tumble play (Fogel & Melson, 1988). Therefore, although preschool children collectively exhibit greater overall activity than older children, it may be that with increasing age the difference in motor activity between ADHD and normal children becomes more obvious.

Lastly, it has been suggested that ADHD children are considered more active than their peers because their movements lack direction and are inappropriate and it is this which makes their activity more salient (Cromwell, Baumeister, & Hawkins, 1963). The disparity between subjective and objective measurement could be accounted for by qualitative differences in the movement of these children. ADHD children were reported by teachers to have significantly more behavioural problems as well as being more active. Behavioural intention of activity may therefore be a key factor. This may result in an attentional bias in adults who remain watchful of these children whose activities frequently cause disruption.

Activity During Sleep

A difference in activity was found during the sleep period. ADHD children exhibited significantly more activity during sleep than their matched comparisons. This was consistent across each of the 3 night sections and in each of the 3 nights and, therefore, appeared to be a reliable finding.

The pattern of activity across the night was similar for both groups (figure 2). However, activity was found to vary across sections of the night. As anticipated, less activity was found during the first section, which is associated with deeper sleep, when compared to the second and third night sections. Furthermore, activity was found to be variable between and within groups. Some of the ADHD sample demonstrated elevated activity scores in comparison to controls whilst others did not and it may have been that two of the ADHD children with very high activity scores accounted for this difference found between group. In five cases, control children had higher mean activity scores than their ADHD comparison.

Sleep Quality

There were four main findings relating to the sleep quality of participants as measured by actigraphy and parental report.

Firstly, parental retrospective report indicated the presence of sleep problems in ADHD children revealing that the majority (7 of the 12) was considered to have sleep difficulties. In contrast, none of the controls were judged to have a sleep problem. Parents reported settling problems, night wakening and bedwetting (table 2) to be the

most frequent cause of their child's sleep disruption. Bedwetting was also reported in some of the control sample. Studies have revealed that this difficulty is prevalent in pre-school boys (Weir, 1982) and, higher in children who show other behavioural disturbances (Richman, Stevenson, & Graham, 1982). Therefore, its presence was expected. Of those who reported sleep problems, few parents considered sleep disruption to interfere with their child's daytime functioning. Interestingly, although ADHD parents reported more sleep problems retrospectively (at the initial interview), diary information completed during the nights of recording failed to differ from that of controls. This indicated that concerns of ADHD parents reported during a consultation with child services might be somewhat exaggerated. Diary information seemed a more reliable source of obtaining sleep information.

The second finding related to the difference noted between parental diary information and actigraphy in the estimation of sleep quality. Objective measurement revealed that parents of ADHD children overestimated bedtime, underestimated rising time and both groups underestimated the duration of night wakenings. Parents- especially of the ADHD group- overestimated children's bedtimes as they recorded times that were beyond sleep onset as judged by actigraphy. It would appear, therefore, that these parents have a perceptual bias towards shortening the sleep period. This created a difficulty when looking at one of the most common complaints made of ADHD children's sleep - a difficulty with settling. As there was no clarity with regards to the actual bedtime of children, the time taken to fall asleep could not be estimated. Visual inspection of diurnal patterns of activity (figure 1) would suggest greater activity levels in ADHD children in the period just prior to sleep. Generally, parental reports over-estimated the presence of

abnormal sleep patterns in ADHD children. Hering, Epstein, Elroy, Iancu and Zeinik (1999) found similar parental over-sensitivity to sleep disturbance in children with autism. They proposed that the *'restless, atypical behaviour'* of these children may disturb the parents even if the night wakenings are no longer or more frequent than those of normal children, who do not disturb their families even when they wake through the night. In addition, parents may be more tired at the end the day and thus less tolerant to deviations from quiet sleep. This may similarly be true of parents of ADHD children.

Thirdly, there were significant compliance difficulties with ADHD parents in the completion of parental diaries. This was not evident of parents of controls. The reasons for this difficulty with reporting are not clearly understood but suggest some difference in parental attitudes and styles. It may be that parents of ADHD children are themselves inherently lacking in structure due to patterns of learning or genetics. Tiredness, as mentioned above, may contribute to this. In addition a higher prevalence of depression (past or current) was apparent in these parents and this vulnerability might also add to problems with compliance.

Finally, this study failed to confirm any difference in the overall sleep quality of the samples measured both by actigraphy and parental diary. There was much variation across and within both groups in measures of sleep quality. Several anomalies in the findings were uncovered. The control group was found to have less wake bouts (actigraphy) during the first night of sleep, a later bed time was recorded by parents for all children during night 2 when compared to night 3, however, objective measurement revealed no difference in bedtime between nights. These irregularities arose in spite of

correcting for chance.

Conceptual Issues

Consistently in the literature adults (teachers, parents and clinicians) have been found to perceive these children as being more active than their normal peers yet frequently, research using objective measurement fails to support this. In a recent paper by Hill and Cameron (1999), ADHD children were described as exhibiting behaviour that is poorly modulated and situationally inappropriate. Perhaps then, it is these qualitative factors in conjunction prevalent behavioural problems that lead to this behaviour being perceived as overactive. That is, instead of exhibiting more behaviour, they may exhibit different behaviour. The deficit in control of arousal theory of ADHD would project difference in arousal during wakefulness as well as sleep. Reports from parents of AHDH children lend support to this theory. However, findings from objective evaluation of activity in present study can provide only limited evidence of quantifiable differences in motor arousal between preschool children with ADHD and their matched comparisons. It appeared that a subgroup of the ADHD children displayed increased activity during sleep. This theory of deficit arousal seems compatible with current speculations about the nature of the differences between activity in ADHD and controls. Rather than activity being greater in ADHD children, it may be that it is different. It is suggested that this 'difference' may lie in a complex interaction between behavioural characteristics of the child (related to the presence of other the core symptoms of ADHD- impulsivity and inattention), physiological factors and the environment. Detailed functional analysis of the behaviour of ADHD children in tandem with objective activity data, observed across differing social contexts, may provide stronger support for such a theory.

Contemporary measurement may lack sensitivity to existent differences between ADHD and normal children's activity. Teicher (1995) recommended the analysis of distributions of activity scores rather than comparison of mean activity levels as a more accurate index of altered activity. Teicher and colleagues (1991) found that whilst mean activity scores were found to overlap significantly among clinical groups, distribution scores of activity proved more reliable at identifying ADHD children. A change in direction of research addressing objective differences in activity from quantity of movement to quality measurements may prove fruitful. Preliminary findings of the use of a relatively new technique, infrared motion analysis, used for a precise determination of movement patterns in ADHD patients are promising (Teicher, Glod, & Wallace, 1993). Further research is required to validate this quantitative measurement method.

Investigation of younger children with ADHD has been a neglected area for research. Much of the concern seems to lie in the diagnosis of ADHD in children prior to school age. Certainly there is more heterogeneity in younger children and it may be that, despite a rigorous selection process, some in the current ADHD sample develop difficulties in future which are consistent with alternative diagnoses. However, the findings of the present study provide a strong argument for greater attention being paid to children presenting with these difficulties in the preschool years. Even at this early age, those children included in this study displayed the full range of behaviours consistent with the diagnosis of ADHD across differing contexts. Furthermore, they presented with significant behaviour problems causing considerable management difficulties at home and in nursery. In some cases this led to restricted access to nursery; in one case, to nursery exclusion. Research has demonstrated that the possession of a primary

hyperactivity disorder is a potent vulnerability factor for the development of other emotional and behavioural difficulties and long term outcome in social, occupational and educational terms is generally poor (Hill & Cameron, 1999). This highlights a need for researchers and clinicians to become proactive in the detection and intervention of ADHD in the younger child.

Summary & Conclusions

Parents of ADHD children were found to report significant daytime over-activity and sleep disruption in their children. Objective evaluation failed to detect differences in daytime activity levels between the ADHD group and their matched controls. However, ADHD children were found to be consistently more active during sleep than their comparisons; this was not true of all children in the ADHD group but a sub-set had very high activity scores. No significant difference was found in sleep pattern or sleep quality parameters between the groups. In general, there was high variability both between and within groups in activity and sleep measures. Consistent with previous findings subjective evaluation by ADHD parents over-estimated both daytime activity and sleep disruption in their children.

It is possible that the ADHD children exhibited greater amounts of activity, yet this remained undetected by the current analysis. Minute by minute actigraphic measurement of activity over 72 hours provides a rich source of information. Although beyond the limits of the current study, these data can be subject to differing analytical methods, such as distributional analysis of activity, in the future. This was the first study to objectively evaluate activity in preschool children, therefore, these findings are preliminary and represent a small number of preschool children with ADHD in the West of Scotland.

Actigraphic monitoring performed in a larger number of subjects may provide more conclusive data on the rest-activity patterns typical of the preschool child with ADHD.

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VARIABLE	ADHD MEAN (S.D.)	CONTROL MEAN (S.D.)	STATISTICAL TEST	P VALUE
CHRONOLOGICAL AGE (YRS)	4.09 (0.61)	3.98 (0.66)	t(22) = 0.43	0.67
HOURS AT NURSERY PER WEEK	14.06 (8.73)	31.17 (10.71)	t(22)= -4.29	<0.001
ICD-10 (TOTAL NO. OF SYMPTOMS REPORTED)	16.83 (1.19)	2.25 (1.71)	u= 0.00	<0.001
ICD-10 (NO. ACTIVITY SYMPTOMS REPORTED)	5.0 (0.0)	0.50 (0.9)	u=0.00	<0.001
CONNERS PARENT'S RATING SCALE(R:L) ADHD INDEX T-SCORE	84.25 (4.14)	42.92 (4.56)	u=0.00	<0.001
CONNERS PARENT'S RATING SCALE(R:L) DSM-IV (Hyperactive Impulsive) T-SCORE	83.0 (4.33)	44.83 (4.28)	u= 0.00	<0.001
CONNERS TEACHERS RATING SCALE(R:L) ADHD INDEX T-SCORE	68.67 (14.97)	46.55 (3.39)	t(19)= 4.78	<0.001
CONNERS TEACHERS RATING SCALE(R:L) DSM-IV(hyperactive Impulsive) T-SCORE	66.67 (15.49)	45.5 (3.23)	t(19)= 4.64	<0.001
PRESCHOOL BEHAVIOUR CHECKLIST	14.56 (10.54)	3.17 (2.04)	u=15.5	0.006

Table 1. Descriptives of the ADHD & Control Samples.

Sleep Difficulty (ADHD n=12, Control n=12)		Never	Very Seldom	Several Times a Month	3-4 times a Week	Nightly
Settling problems	Control	7	2	2	1	0
	ADHD	4	1	1	1	5
Waking During the Night	Control	8	3	1	0	0
	ADHD	2	3	0	2	5
Nightmares	Control	10	2	0	0	0
	ADHD	5	3	2	1	1
Night Terrors	Control	12	0	0	0	0
	ADHD	8	1	1	2	0
Sleepwalking	Control	11	1	0	0	0
	ADHD	11	1	0	0	0
Talking During Sleep	Control	7	3	1	1	0
	ADHD	6	2	1	1	2
Bedwetting	Control	7	4	0	0	1
	ADHD	5	2	0	0	5

Table 2. Parental Reports at Assessment of Sleep Difficulties in ADHD and Control Children.

ANOVA Repeated Measures Designs (2x3)	Parental Diary					Actigraphy (n=12)				
	df	F	p	Mean (sd) ADHD	Mean (sd) Control	df	F	p	Mean (sd) ADHD	Mean (sd) Control
Rising Time										
Night	2	0.69	0.51	n=10	n=12	2	1.45	0.25		
Night* Group	2	0.35	0.97	7.37	7.50	2	0.31	0.73	7.87	7.19
Group	1	0.70	0.99	(1.19)	(0.98)	1	3.33	0.82	(1.13)	(0.93)
Bedtime										
Night	2	6.03	0.005**	n=10	n=12	2	3.94	0.68		
Night* Group	2	3.81	0.03*	21.14	20.48	2	0.33	0.72	20.35	20.33
Group	1	1.33	0.26	(1.99)	(0.75)	1	0.001	0.97	(3.33)	(1.20)
Total Sleep Time										
Night	2	0.14	0.87	n=7	n=12	2	0.63	0.54		
Night* Group	2	0.05	0.95	9.57	10.91	2	0.53	0.59	9.34	9.57
Group	1	2.60	0.12	(2.25)	(2.28)	1	0.57	0.46	(1.16)	(1.04)
WASO										
Night	2	1.15	0.33	n=5	n=9	2	0.96	0.39		
Night* Group	2	0.29	0.75	22.33	8.61	2	2.30	0.11	76.20	63.00
Group	1	8.18	0.23	(38.25)	(20.49)	1	1.47	0.24	(34.80)	(30.00)
Number of Wakeningst										
Night	2	1.38	0.27	n=7	n=11	2	0.78	0.92		
Night* Group	2	0.45	0.19	1.0	0.42	2	3.95	0.03*	35.89	31.97
Group	1	1.89	0.19	(1.2)	(0.59)	1	1.16	0.29	(9.81)	(11.36)

† Actigraphiy measures the number of wake bouts (a more sensitive measure) rather than number of actual wake periods.

* Significant at 0.05 level.** Significance at 0.01 level. WASO wake time after sleep onset.

Table 3. Between Groups Comparison of Sleep Parameters. Parental Diary Information and Actigraphy.

Figure1 Diurnal Patterns of Actigraphically Monitored Activity for Preschool Children

(mean values of 1 hourly epochs)

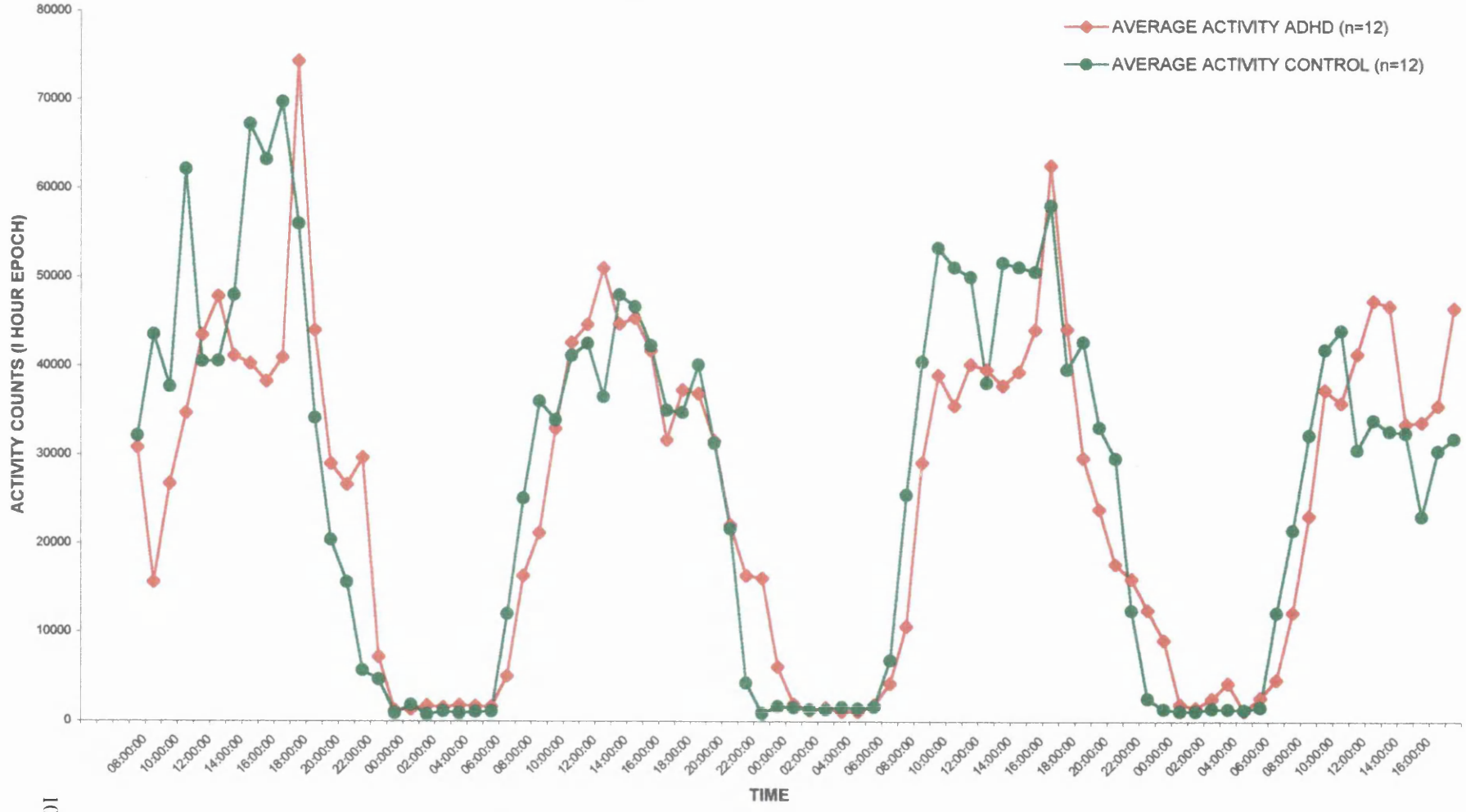


Figure 2 Average Mean Activity Scores for Groups for Night Sections

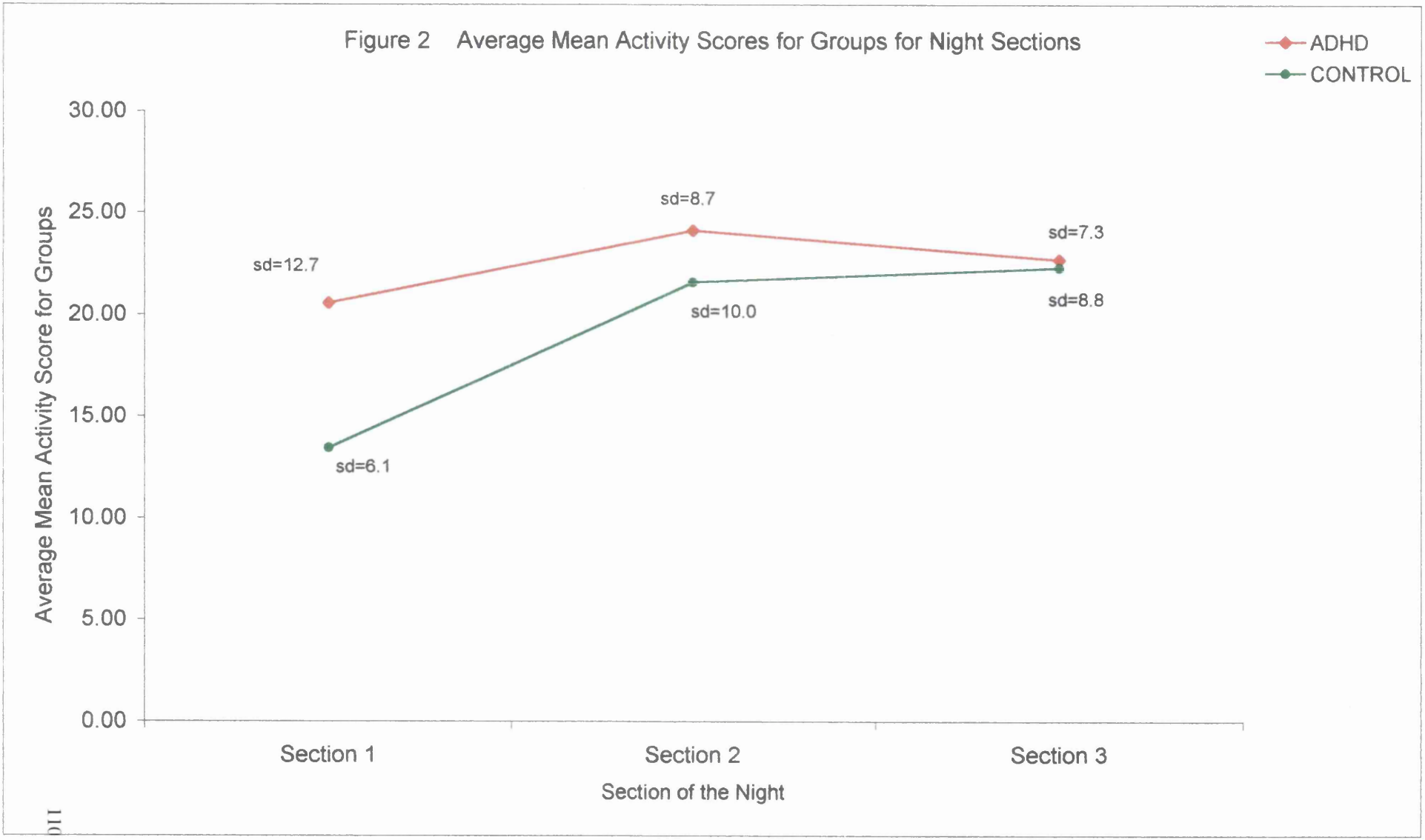
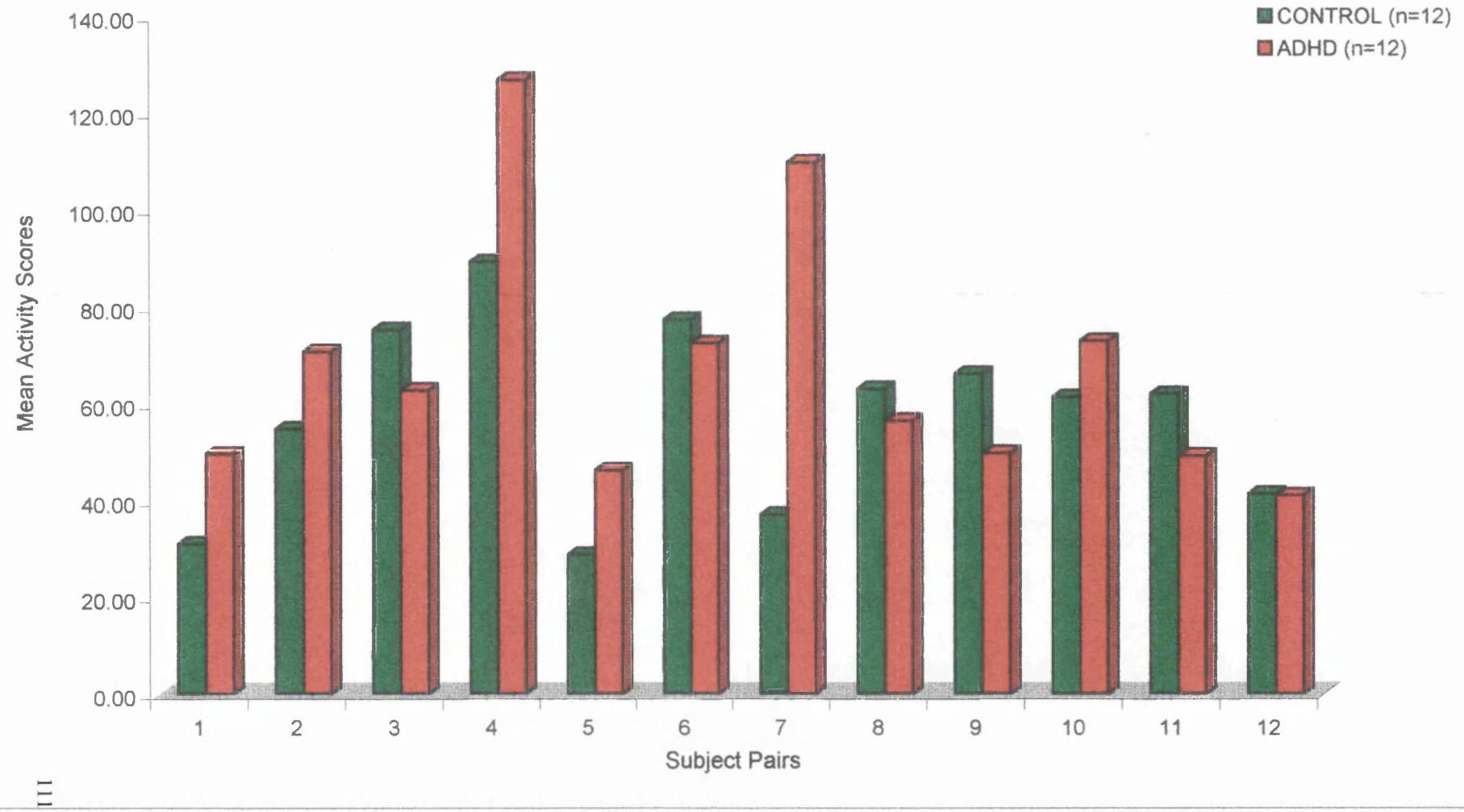


Figure 3 Paired Comparison of Mean Activity Scores Across Nights



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5. Single Subject Research Study (Abstract)

A Single Case Investigation of the Relationship between Performance Experience, Mood and Self-Efficacy in a Depressed Individual.

Running Head: Performance Experience, Mood and Self-efficacy in Depression

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Prepared in accordance with the instructions to authors
for *Behavioural and Cognitive Psychotherapy.*

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Abstract

Bandura (1986a) proposed performance experience to be the most powerful source of self-efficacy information. The importance of performance experience as a therapeutic component is highlighted by its frequent inclusion in the form of behavioural experiments or task assignments. A behavioural experiment was performed with a 43-year old client with recurrent severe depression to test the specific prediction that successful performance experience would lead to alterations in judgements related to achievement of a desired level of performance (sense of achievement) and mood, with the ultimate goal of increasing personal self-efficacy. The design employed was similar to a changing-criterion design but with parallel measurement of mood and sense of achievement ratings. Improvement in self-reported 'mood' and 'sense of achievement' following task engagement was observed. Self-generated activity also resulted in increased ratings providing additional weight to this finding. A positive relationship between the clients rating of 'mood' and 'sense of achievement' was also revealed. However, an alternative explanation for the observed increase in ratings was considered. Observed fluctuations in ratings may have been the result of an artifact of time. Consequently, this experiment was unable to clearly demonstrate a relationship between task engagement and client's ratings independent of this time factor, and the experimental hypothesis was unable to be confirmed. Significant clinical gains were made. However, standardised measures of mood and self-esteem failed to reflect changes in the client's presentation. Reasons for the findings are proposed. Methodological difficulties are discussed and recommendations for improved design are provided.

Keywords: mood, self-efficacy, achievement, depression, performance experience.

6. Appendices

Appendix 1

1.1 Correspondence to participants

1.2 Postal Survey Questionnaire

1.3 Notes for contributors for Health Bulletin

Appendix 1.1

Division of Clinical Psychology

Direct Line: 0141-211
Fax: 0141-357 4899
E-mail:

UNIVERSITY *of* GLASGOW

April, 1998

Dear Clinical Psychologist

Re:- Care Programming in CMHT's in Adult Services, Glasgow.
Small Scale Research Project

As you are aware, following the 1990 guidelines issued from the Department of Heath, the Care Programming approach has recently been implemented in Glasgow. This has been to improve the management of care for clients with severe mental illness either leaving psychiatric hospitals or for those whose care is already being managed in the community.

As a first year trainee of the Doctorate in Clinical Psychology Course at Glasgow, I am embarking on a small scale evaluation project concerning the contributions and views of Clinical Psychologists working in CMHT's in Glasgow with clients registered with Care Programming. I recognise how busy you are as clinicians however, I would very much appreciate your willingness in helping me with my research in this area. This would involve you completing the attached questionnaire, which should take approximately 15minutes of your time, and returning it to me in the pre-paid envelope provided before the 20th of May, 1998.

I am aware that due to it's very recent implementation, some clinicians may have no contact with Care Programming clients or very limited input to date, however any information you could share with me would be valuable.

With sincere thank you for help and co-operation,

Stephanie Brindle
Clinical Psychologist in Training

DEPARTMENT OF PSYCHOLOGICAL MEDICINE
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Head of Department: Professor C A Espie

Division of Clinical Psychology

Direct Line: 0141-211
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UNIVERSITY
of
GLASGOW

15th June, 1998

Dear Clinician,

Re:- Care Programming in CMHT's in Adult Services, Glasgow.
Small Scale Research Project

As a first year trainee of the Doctorate in Clinical Psychology Course at Glasgow, I am undertaking a small scale evaluation project concerning the contributions and views of Clinical Psychologists working in CMHT's in Glasgow with clients registered with Care Programming. You may remember receiving a questionnaire from me last month.

I would like to take this opportunity to thank those who have helped with this research by returning their questionnaires.

I would be extremely grateful to receive any further questionnaires from those clinicians who have not yet managed to return these, as this information would be very valuable.

With sincere thanks for your help and co-operation,

Stephanie Brindle
Clinical Psychologist in Training

DEPARTMENT OF PSYCHOLOGICAL MEDICINE
Academic Centre, Gartnavel Royal Hospital, 1055 Great Western Road, Glasgow G12 0XH
Head of Department: Professor C A Espie

Appendix 1.2

Care Programming

A Survey of the Involvement and Views of Clinical Psychologists Working in CMHT's in Glasgow

Section 1 ***Background Information***

1. What is your understanding of the key factors relating to Care Programming?

2. Did you receive any information about Care Programming before it was implemented?

   Yes ❑ No ❑

   If **Yes**, please specify.

   Documentation on the Glasgow Pilot Project ❑
   Other documentation ❑
   Informal discussion with colleagues ❑
   Other, please specify _____

3. Did you receive any training?

   Yes ❑ No ❑ Offered but did not attend ❑

   If yes, please specify. (Please include duration)

4. How long have you been working with this CMHT?

   <6 months ❑ 6-12 months ❑ 12-18 months ❑

   18-24 months ❑ >2 years ❑

5. Approximately how long has this CMHT been together?

<6 months ❑ 6-12 months ❑ 12-18 months ❑

18-24 months ❑ >2 years ❑

6. Are you a full time member of this team?

Yes ❑ No ❑

If **No**, how many sessions per week do you work in this team? ❑

7. In CMHT work, how many clients do you currently have which involves **joint** work with one or more members of the team? (Where **joint work** refers to cases that involve shared planning and shared input of work.)

(Please **include** clients who are being seen by trainees and assistants under your supervision.)

❑

8 In CMHT work, how many of your current cases involve working on an individual basis with a client?

(Please **include** clients who are being seen by trainees and assistants under your supervision.)

❑

Section 2 ***Level of Current Involvement***

1. Have you been involved with Care Programming clients?
(Please **include** clients who were seen by trainees and assistants under your supervision.)

Yes ❑ No ❑

If **No**, please specify what you consider to be the main reasons for this in the space below.

If No, Please move on to Section 3

If **Yes**, how many? ❑

2. Please tick the box to indicate that you have been involved in the following:-

Attended Care Programming Review meeting(s)	❑	If yes, how many?	❑
Fulfilled the role of keyworker for a Care Programming client	❑	If yes, how many?	❑
In the production of a Care Plan	❑	If yes, how many?	❑

3. Were any of the cases assessment only?

Yes ❑ No ❑

If **yes,** how many? ❑

4. What type of assessments have you been involved in with Care Programming clients?

Neuropsychological	❑	If yes, how many?	❑
Risk assessment	❑	If yes, how many?	❑
Diagnostic	❑	If yes, how many?	❑
Level of functioning for rehabilitation	❑	If yes, how many?	❑
Suitability for psychological treatment	❑	If yes, how many?	❑
Systemic assessment	❑	If yes, how many?	❑

If other, please specify.

5. Were any of them treatment cases?

Yes ❑ No ❑

If **yes**, how many? ❑

6. What type of treatments have you provided for Care Programming clients?

Cognitive Behavioural Therapy	❑	If yes, how many cases? ❑
Behavioural Therapy	❑	If yes, how many cases? ❑
Cognitive Therapy	❑	If yes, how many cases? ❑
Psychoanalytic Therapy	❑	If yes, how many cases? ❑
Counselling	❑	If yes, how many cases? ❑
Systemic Therapy	❑	If yes, how many cases? ❑
Social Skills Training	❑	If yes, how many cases? ❑

If other, please specify

7. Have **ALL** the referrals you have received for Care Programming been appropriate?

Yes ❑ No ❑

If **No**, in what way were they **inappropriate**?

8. In Care Programming work, how many clients have you seen (or are currently seeing) which have involved **joint** work with one or more members of the team? (Where **joint work** refers to cases that involve shared planning and shared input of work.)
(Please include clients who were seen by trainees and assistants under your supervision.)

❑

9. In Care Programming work, how many cases have involved you working on an individual basis with a client? (Please include clients who were seen by trainees and assistants under your supervision.)

❑

10. Have **you** referred on, or made a recommendation that another Clinical Psychologist working in a specialist area should see a Care Programming client?

Yes ❑ No ❑

If **YES**, please specify which specialist service was required.

11. Has the introduction of Care Programming made a significant impact on your practice?

Yes ❑ No ❑

If **Yes,** in what ways?

If **No,** why might this be?

Section 3 ***Your Views***

1. Is the nature of your work that you are doing in relation to Care Programming any different for CMHT work?

Yes ❑ No ❑

If **YES**, in what way(s)?

2. What, in your opinion, are the **benefits** of the Care Programming approach?

3. What, in your opinion, are the **problems** with this approach?

4. How would you rate the collaborative working relationship you have developed as part of Care Programming?

Successful	❑	Unsuccessful	❑
Requires further development	❑	Too early to say	❑

5. Do you view Care Programming as being beneficial to:-

Client ❑	Carers ❑ (Family members, care assistants etc.)	Care Providers ❑ (CMHT workers, Social Workers, Nursing Staff, Housing Agency, GP's, Voluntary staff etc.)

6. Where do you think Clinical Psychology fits with this approach to case management and care?

7. How do you view your current level of involvement with Care Programming?

Involved to a lesser extent than I would like to be ❑

Appropriate ❑

Involved to a greater extent than I would like to be ❑

8. Do you perceive your level of involvement in the future to:-

Increase ❑ Stay the same ❑ Decrease ❑ Unsure ❑

9. In your opinion, how does this approach compare with the situation before Care Programming was introduced?

Better ❑ No different ❑ Worse ❑

Please use the space below to highlight any other issues that you wish to raise which have not been mentioned already.

Many thanks for your co-operation in the completion of this questionnaire.

Appendix 1.3

Notes for Contributors

Papers, articles and other contributions should be sent to the Editor, *Health Bulletin*, Scottish Executive Health Department, Room IE05, St Andrew's House, Edinburgh EH1 3DE. They must be submitted exclusively for *Health Bulletin*. Acceptance is on the understanding that editorial revision may be necessary. All papers are reviewed by the Editor and by peer review, referees being drawn from a panel of appropriate professionals. No correspondence can be entered into in relation to articles found to be unsuitable and returned to authors.

Potential contributions can be submitted in two ways. Material submitted for publication must be typewritten on one side of the paper only, in double spacing and with adequate margins, and each page should be numbered. The top typed copy should be submitted, with four other copies. We are willing to receive one copy typewritten in the above format and accompanied by a disk (Microsoft Word version 98, Excel for tables and figures). All papers should be prefaced by a structured Abstract, of about 250 words in length. It should normally contain six clearly headed sections entitled Objective, Design, Setting, Subjects, Results and Conclusion. The name, appointment and place of work of the authors should be supplied on a separate title page. This same page should include the full postal address of one author, to whom correspondence and reprints will be directed. There should be adequate references to any relevant previous work on the subject; these references should appear at the end of the material on a separate page or pages, using the Vancouver style, which in the case of papers in journals includes:

Surname and initials of author(s)
Title of paper
Full name of journal
Year published
Volume number
Opening and closing page numbers

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Proofs

Contributors will receive one set of proofs. This should be read carefully for printer's errors, and any tables, figures and legends should be checked. Alterations should be kept to a minimum, and the proofs should be returned promptly.

Reprints

Ten reprints will be supplied free of charge.

Appendix 2.

Notes for contributors for the Journal of Child Psychology and Psychiatry and Allied Disciplines

THE JOURNAL OF
CHILD PSYCHOLOGY AND PSYCHIATRY
AND ALLIED DISCIPLINES

Notes for Contributors

General

1. Submission of a paper to the Journal will be held to imply that it represents an original contribution not previously published (except in the form of an abstract or preliminary report); that it is not being considered for publication elsewhere; and that, if accepted by the Journal, it will not be published elsewhere in the same form, in any language, without the consent of the Editors. When submitting a manuscript, authors should state in a covering letter whether they have currently in press, submitted or in preparation any other papers that are based on the same data set, and, if so, provide details for the Editors.

Ethics

2. Authors are reminded that the Journal adheres to the ethics of scientific publication as detailed in the *Ethical principles of psychologists and code of conduct* (American Psychological Association, 1992). These principles also imply that the piecemeal, or fragmented publication of small amounts of data from the same study is not acceptable.

3. Papers should be submitted to the Joint Editors, care of:

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Alternatively, papers may be submitted directly to any of the Corresponding Editors whose addresses are shown on the first page. Upon acceptance of a paper, the author will be asked to transfer copyright to the ACPP.

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1. Manuscripts should be typewritten, **double spaced throughout including references and tables**, with wide margins, on good quality A4 paper, using one side of the page only. Sheets should be numbered consecutively. **Four** copies should be sent. The author should retain a copy of the manuscript for personal use. Fax and electronic mail should **not** be used for initial submission of manuscripts.
2. Papers should be concise and written in English in a readily understandable style. Care should be taken to avoid racist or sexist language, and statistical presentation should be clear and unambiguous. The Journal follows the style recommendations given in the *Publication manual of the American Psychological Association* (4th edition, 1994), available from the Order Department, APA, PO Box 2710, Hyattsville, MD 20784, USA.
3. The Journal is **not** able to offer a translation service, but, in order to help authors whose first language is not English, the Editors will be happy to arrange for accepted papers to be prepared for publication in English by a sub-editor.
4. Authors whose papers have been given **final acceptance** are encouraged to submit a copy of the final version on computer disk, together with two hard copies produced using the same file. Instructions for disk submission will be sent to authors along with the acceptance letter. Do **not** send a disk with initial submission of paper.

Layout

1. *Title*: The first page of the manuscript should give the title, name(s) and address(es) of author(s), and an abbreviated title (running head) of up to 80 characters. Specify the author to whom reprint requests should be directed. The covering letter should clearly state the name and address of the person with whom the Editors should correspond, giving also if possible a fax and email address. Authors requesting **masked review** should provide a first page with the title only and adapt the manuscript accordingly.
2. *Abstract*: The abstract should not exceed 300 words.
3. *Acronyms*: In order to aid readers, we encourage authors who are using acronyms for tests or abbreviations not in common usage to provide a list to be printed after the abstract.
4. *Headings*: Original articles and research reports should be set out in the conventional form: Introduction, Materials and Methods, Results, Discussion, and Conclusion. To save space in the Journal, the Method will be printed in smaller typeface. Descriptions of techniques and methods should be given in detail only when they are unfamiliar.
5. *Acknowledgements*: These should appear on a separate sheet at the end of the text of the paper, before the References.

Referencing

The Journal follows the text referencing style and reference list style detailed in the *Publication manual of the American Psychological Association.*

(a) *References in text.*

References in running text should be quoted as follows: Smith and Brown (1990), or (Smith, 1990), or (Smith, 1980, 1981a, b), or (Smith & Brown, 1982), or (Brown & Green, 1983; Smith, 1982).

For up to five authors, all surnames should be cited the first time the reference occurs, e.g. Smith, Brown, Green, Rosen, and Jones (1981) or (Smith, Brown, & Jones, 1981). Subsequent citations should use "et al." (not underlined and with no period after the "et"), e.g. Smith et al. (1981) or (Smith et al., 1981).

For six or more authors, cite only the surname of the first author followed by "et al." and the year for the first and subsequent citation. Note, however, that **all** authors are listed in the Reference List.

Join the names in a multiple author citation in running text by the word "and". In parenthetical material, in tables, and in the Reference List, join the names by an ampersand (&).

References to unpublished material should be avoided.

(b) *Reference list.*

Full references should be given at the end of the article in alphabetical order, and not in footnotes. **Double spacing** must be used.

References to journals should include the authors' surnames and initials, the full title of the paper, the full name of the journal, the year of publication, the volume number, and inclusive page numbers. Titles of journals must not be abbreviated and should be italicised (underlined).

References to books should include the authors' surnames and initials, the full title of the book, the place of publication, the publisher's name and the year of publication.

References to articles, chapters and symposia contributions should be cited as per the examples below:

Kiernan, C. (1981). Sign language in autistic children. *Journal of Child Psychology and Psychiatry, 22*, 215–220.

Jacob, G. (1983a). Development of coordination in children. *Developmental Studies, 6*, 219–230.

Jacob, G. (1983b). Disorders of communication. *Journal of Clinical Studies, 20*, 60–65.

Thompson, A. (1981). *Early experience: The new evidence.* Oxford: Pergamon Press.

Jones, C. C., & Brown, A. (1981). Disorders of perception. In K. Thompson (Ed.), *Problems in early childhood* (pp. 23–84). Oxford: Pergamon Press.

Use Ed.(s) for Editor(s); ed. for edition; p.(pp.) for page(s); Vol. 2 for Volume 2.

Tables and Figures

These should be constructed so as to be intelligible without reference to the text. The approximate location of figures and tables should be clearly indicated in the text. Figures will be reproduced directly from the author's original drawing and photographs, so it is essential that they be of professional standard. Computer generated figures must be laser printed. Illustrations for reproduction should normally be twice the final size required. Half-tones should be included only when essential, and they must be prepared on glossy paper and have good contrast. All photographs, charts and diagrams should be referred to as "Figures" and numbered consecutively in the order referred to in the text. Figure legends should be typed on a separate page.

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No rigid rules are observed, but each paper must be consistent within itself as to nomenclature, symbols and units. When referring to drugs, give generic names, not trade names. Greek characters should be clearly indicated.

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Appendix 3.

3.1 Structured assessment interview

3.2 Information sheets for parents of subjects and controls

3.3 ICD-10 research diagnostic criteria

3.4 Parents diary sheet

3.5 Parents consent form

3.6 Approval from Trusts ethics committees

Appendix 3.1

ASSESSMENT INTERVIEW

Date of interview:_

Name of child:-

Age in months:-

Date of birth:-

Address:-

Telephone No:-

Placement of the Child

1. Child living with both natural parents
2. Child living with natural mother only with/without father substitute
3. Child living with natural father only with/without mother substitute
4. Child living with other relatives
5. Child living with foster parents or in an institution
6. Adoption
7. Other

Birthplace of the child:-

Number of people living in household:-

Siblings

No. of siblings half-siblings step-siblings

Age of siblings _____

Mothers age

Fathers age

Occupation of the Carer(s)

Mothers occupation:-

Fathers occupation:-

Has_____ever had to go into hospital? YES / NO

	Reason	Age	Hospital	Length of Stay
1)				
2)				
3)				
4)				
5)				

Family Doctor:-_____

Address:-

Is your child currently on medication ? YES / NO

If yes, what?

Pregnancy & Neonatal History

Were there any complications whilst you were carrying _____? YES / NO
Please specify:- (such as; infection, mother's mental health problem, mother's physical illness, high BP, toxaemia, haemorrhage)

Admission into hospital during pregnancy? YES / NO

Details of the Delivery

Was your child born on time /early /late ?

Child delivered at 41 to 43 weeks 39 to 41 weeks 37 to 38 weeks
34 to 36 weeks less than 34 weeks not known

Birthweight? <3lbs 3-4.5lbs 4.5-6lbs 6-7.5lbs
7.5-10lbs >10lbs not known

Any problems with the delivery? YES / NO

Any problems with baby after birth? YES / NO

Special treatments required? YES / NO

Developmental Milestones

When did your child start to walk? ☐

When did your child start to talk? (first words) ☐

Can your child now
1. say all words clearly
2. a few words unclear (<5)
3. many words unclear (>5)
4. most words not understood by others
5. not known

Have you ever been worried about his/her speech or language at any time to the extent that you felt professional help was needed? YES / NO

Where and for how long?

Problems with hearing? YES / NO _____

Problems with vision? YES / NO _____

Sleep History

Does your child sleep in his/her own bed? YES/ NO

If not where?
1. Beside parent(s)
2. Beside sibling
3. Elsewhere. Please specify_____

Has your child had any of the following in the 6months year:-

Nightmares	nightly / 3-4 times week / several times a month / very seldom/ NA
Wake- up screaming (night terrors)	nightly / 3-4 times week / several times a month / very seldom/ NA
sleepwalking	nightly / 3-4 times week / several times a month / very seldom/ NA
sleeptalking	nightly / 3-4 times week / several times a month / very seldom/ NA
bedwetting	nightly / 3-4 times week / several times a month / very seldom/ NA
problems getting off to sleep	nightly / 3-4 times week / several times a month / very seldom/ NA

waking during the night	nightly / 3-4 times week / several times a month / very seldom/ NA
early morning wakening	nightly / 3-4 times week / several times a month / very seldom/ NA

How long does your child sleep approximately during the night? ☐

Usual bedtime:- ☐

Usual rising time:- ☐

If sleep difficulties exist:-

Does your child's sleep difficulty interfere with his/her daytime activities? YES / NO

Would you rate this interference as:-

mild **moderate** **severe**

Does your child nap during the day? YES / NO

If yes, between the hours of_____ and _____

between the hours of_____ and _____

For how long **in total** does your child nap during the day? (hours/minutes) ☐

How would you rate your child's sleep problem:-

No problem **Mild** **Moderate** **Severe**

Does your child have any other difficulty with physical health, mental health or learning that you have not already stated but which would be important for me to know about? YES / NO
Please specify:

History of Family Illness

	Physical conditions	Psychological problems
Maternal illness:-		

Physical conditions Psychological problem

Paternal illness:-

Illness of siblings:-

Nursery School History

Does your child attend nursery school (playgroup or other equivalent)? YES /NO

Name & Address of the Nursery
Name of the Nursery Teacher

How many hour each week does your child attend nursery? [ ]

Days

Mornings:-

Afternoons:-

Have there been any difficulties with nursery? YES / NO

Check the following areas:-

Learning	YES / NO
Behaviour	YES / NO
Getting on with teacher's	YES / NO
Getting on with other children	YES / NO

Gain consent to contact the nursery.

Symptom Checklist

During the past six months, which of these difficulties have you noticed with your child. Please record by ticking the boxes next to those statements that are true of your child.

Attention

1. Often fails to give close attention to details, or makes careless errors in schoolwork, work, or other activities ☐
2. Often fails to sustain attention in tasks or play activities ☐
3. Often appears not to listen to what is being said to him/her ☐
4. Often fails to follow through on instructions or to finish schoolwork, chores, or duties ☐
5. Often has difficulty organising tasks or activities ☐
6. Often avoids or strongly dislikes tasks which involve him/her to concentrate ☐
7. Often loses things necessary for certain tasks or activities such as books, toys ☐
8. Often is easily distracted by what is going on around him/her ☐
9. Is often forgetful in the course of daily activities ☐

Activity

1. Often fidgets with hands or feet or squirms on seat ☐
2. Leaves seat in nursery or in other situations in which remaining seated is expected ☐
3. Often runs about or climbs excessively in situations which it is inappropriate ☐
4. Often is unduly noisy in playing or has difficulty in engaging quietly in leisure activities ☐
5. Is persistently on the go irrespective of where he /she is or with whom ☐

Control

1. Often blurts out answers before questions are completed ☐
2. Often fails to wait in line or await turns in games or group situations ☐
3. Often interrupts or butts into others conversations or games ☐
4. Often talks excessively irrespective of the situation ☐

These difficulties occur:-

Home ☐ Nursery ☐ At Friends/Family ☐ In public places ☐

Notes for Clinicians

In addition:-

Diagnostic criteria for inattention (attention)	≥6 symptoms ≥ 6 months
Diagnostic criteria for overactivity (activity)	≥3 symptoms ≥ 6 months
Diagnostic criteria for impulsivity (control)	≥1 symptom ≥ 6 months

- This difficulty occurs in >1 situation
- Onset before 7 years of age

- Symptoms must be present to a degree that is maladaptive and inconsistent with the developmental level of the child.
- Symptoms cause clinically significant distress or impairment in social, academic or occupational functioning.
- The disorder does not meet the criteria for pervasive developmental disorders(F84.-), manic episode (F30.-), depressive episode (F32,-), or anxiety disorders (F41,-)

Appendix 3.2

Information Sheet

The Assessment of Activity and Sleep of Pre-school Children with Behaviour Problems Related to Attention and Activity.

Background

Behaviour problems are common in childhood. Some children can have problems with attention, they may also be very active and can have difficulties controlling their own behaviour. There has been a lot of interest in this group of children and many research studies have been carried out. We already know from research that many children who have these difficulties can also have problems sleeping. However, most of the research has taken place with school age children. Currently, little is known about the sleep and activity of the pre-school child with problem behaviour. Therefore, this project has been set up to discover more about some of the difficulties pre-school children with these problems have with sleep and activity. In order to do this, the sleep and activity of children with behavioural problems will be measured and compared to that of children of the same age who do not have problems with their behaviour.

What Does Participation Involve?

You do not have to participate in this study. Participation is entirely on a voluntary basis.

- You will be invited to meet the researcher who will ask you some questions about your child.

- You will be asked to complete a simple diary of the time you child went to bed, whether he/she woke during the night and how long he/she slept.

- You will be asked to allow your child to wear an Actigraph, which looks like a small wristwatch and measures activity, for the duration of three days and nights.

- We will ask to contact your child's nursery or playgroup and request that his/her teacher completes two short questionnaires about your child.

  All information gained about your child will be kept strictly confidential.

How might this help?

Information gained from the study will help us reach a better understanding of the nature of activity and sleep in pre-school children. Where appropriate, the information will be shared with the psychologist or doctor involved with your child. This information may be helpful for further assessment and treatment. It may also lead to the earlier detection of problems in children with similar difficulties.

Thank you for taking the time to read this information sheet.

Information Sheet (C)

The Assessment of Activity and Sleep of Pre-school Children with Behaviour Problems Related to Attention and Activity.

Background

Behaviour problems are common in childhood. Some children can have problems with attention; they may also be very active and can have difficulties controlling their own behaviour. There has been a lot of interest in this group of children and many research studies have been carried out. We already know from research that many children who have these difficulties can also have problems sleeping. However, most of the research has taken place with school age children. Currently, little is known about the sleep and activity of the pre-school child with problem behaviour. Therefore, this project has been set up to discover more about some of the difficulties pre-school children with these problems have with sleep and activity.

In order to look at any differences with the activity and sleep of children referred to a clinic for behaviour problems we need to be able to compare these children with children of the same age and gender who **do not** have these difficulties. Therefore, you have been asked to volunteer your child to provide a comparison for a child who has been referred to a clinic for behavioural problems relating to attention and activity.

What Does Participation Involve?

You do not have to participate in this study. Participation is entirely on a voluntary basis.

- You will be invited to meet the researcher who will ask you some questions about your child.

- You will be asked to complete a simple diary of the time you child went to bed, whether he/she woke during the night and how long he/she slept.

- You will be asked to allow your child to wear an Actigraph, which looks like a small wristwatch and measures activity, for the duration of three days and nights.

- We will ask to contact your child's nursery or playgroup and request that his/her teacher completes two short questionnaires about your child.

  All information gained about your child will be kept strictly confidential.
  If, during this process, significant difficulties with your child's activity or sleep are identified then support will be provided to ensure you gain access to the appropriate service.

How might this help?

Information gained from the study will help us reach a better understanding of the nature of activity and sleep in pre-school children. This information may be helpful for further assessment and treatment. It may also lead to the earlier detection of problems in children with similar difficulties.

Thank you for taking the time to read this information sheet.

Appendix 3.3

Figure 1

ICD-10 Research Diagnostic Criterion for Hyperkinetic Disorders (F90)

Note: The research diagnosis of hyperkinetic disorder requires the definite presence of abnormal levels of inattention, hyperactivity, and restlessness that are pervasive across situations and persistent over time and that are not caused by other disorders such as autism or affective disorders.

G1. *Inattention.* At least six of the following symptoms of inattention have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often fails to give close attention to details, or makes careless errors in schoolwork, work or other activities;
2. often fails to sustain attention in tasks or play activities;
3. often appears not to listen to what is being said to him or her;
4. often fails to follow through on instructions or to finish schoolwork, chores, or duties in the workplace (not because of oppositional behaviour or failure to understand instructions);
5. is often impaired in organising tasks and activities;
6. often avoids or strongly dislikes tasks, such as homework, that require sustained mental effort;
7. often loses things necessary for certain tasks or activities, such as school assignments, pencils, books, toys, or tools;
8. is often easily distracted by external stimuli;
9. is often forgetful in the course of daily activities.

G2. *Hyperactivity.* At least three of the following symptoms of hyperactivity have persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often fidgets with hands or feet or squirms on seat;
2. leaves seat in classroom or in other situations in which remaining seated is expected;
3. often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, only feelings of restlessness may be present);
4. is often unduly noisy in playing or has difficulty in engaging quietly in leisure activities;
5. exhibits a persistent pattern of excessive motor activity that is not substantially modified by social contexts or demands.

G3. *Impulsivity.* At least one of the following symptoms of impulsivity has persisted for at least 6 months, to a degree that is maladaptive and inconsistent with the developmental level of the child:

1. often blurts out answers before questions have been completed;
2. often fails to wait in lines or await turns in games or group situations;
3. often interrupts or intrudes on others (e.g. butts into others' conversations or games);
4. often talks excessively without appropriate response to social constraints.

G4. Onset of the disorder is no later than the age of 7 years.

G5. *Pervasiveness.* The criteria should be met for more than a single situation, e.g. the combination of inattention, and hyperactivity should be present both at home and at school, or at both school and another setting where children are observed, such as a clinic. (Evidence for cross-situationality will ordinarily require information from more than one source; parental reports about classroom behaviour, for instance, are unlikely to be sufficient.)

G6. The symptoms in G1-G3 cause clinically significant distress or impairment in social, academic, or occupational functioning.

G7 The disorder does not meet the criteria for pervasive developmental disorders (F84.-), manic episode (F30.-), depressive episode (F32,-), or anxiety disorders (F41.-).

Appendix 3.4

Measuring the Pattern of Your Child's Sleep

Name:.....

	DAY 1 date.....	DAY 2 date.....	DAY 3 date.....
At what time did your child rise from bed this morning?			
At what time did your child go to bed last night?			
How long approximately did it take your child to fall asleep (please give your answer in minutes)?			
To your knowledge, how many times did your child waken during the night?			
How long do you think your child was awake **in total** during the night (please give your answer in mins)?			
About how long did your child sleep altogether (Hours/minutes)?			

Daytime Activities

How many times did your child nap during the day?			
How long **in total** did your child nap during the day (minutes)?			
Please record the times at which the actiwatch was removed and for what reason.			
How many hours was your child at nursery/playgroup/club (structured activities) today?			

Appendix 3.5

Research Consent Form

An Assessment of Activity and Sleep of Pre-school Children with Behaviour Problems Related to Attention and Activity.

Stephanie Inglis & Professor Colin Espie, Department of Psychological Medicine, University of Glasgow, Academic Centre, Gartnavel Royal Hospital, 1055 Great Western Road, Glasgow,G12 0XH.

This project has been set up to discover more about some of the problems pre-school children have with sleep and activity.

Participation in this study may involve the completion of questionnaires and a daily dairy sheet of your child's activities and sleep pattern over a period of three days and nights. In addition, your child may be asked to wear on his/her wrist a small device used to measure activity, which resembles a small wristwatch, for the same period. We may wish to contact your child's nursery or playgroup and request that his or her teacher completes two questionnaires about your child. All information derived from this study will be keep strictly confidential.

I consent to myself and my child participating in this research study. I understand that I may withdraw my child from the study at any time.

Child's name: .....

Your relationship to the child: .....

Signed ..... Date.....

Signature of Clinician: .....

Research Consent Form (C)

An Assessment of Activity and Sleep of Pre-school Children with Behaviour Problems Related to Attention and Activity.

Stephanie Inglis & Professor Colin Espie, Department of Psychological Medicine, University of Glasgow, Academic Centre, Gartnavel Royal Hospital, 1055 Great Western Road, Glasgow,G12 0XH.

This project has been set up to discover more about some of the problems pre-school children have with sleep and activity.

You have been invited to volunteer your child (a child identified as having no behavioural problems related to attention and activity) to provide a comparison for a child who has been referred to a clinic for behavioural problems relating to attention and activity.

Participation in this study will involve the completion of questionnaires and a daily dairy sheet of your child's activities and sleep pattern over a period of three days and nights. In addition, your child will be asked to wear on his/her wrist a small device used to measure activity, which resembles a small wristwatch, for the same period. We will wish to contact your child's nursery or playgroup and request that his or her teacher completes two questionnaires about your child. All information derived from this study will be keep strictly confidential.

I consent to myself and my child participating in this research study. I understand that I may withdraw my child from the study at any time.

Child's name: .....

Your relationship to the child: .....

Signed ..... Date.....

Signature of Clinician: .....

Appendix 3.6

YORKHILL NHS TRUST

Accredited by the King's Fund Organisational Audit.

Our Ref.

Your Ref.

Direct Dial No.

EM/

1 August 1999

Ms Stephanie Inglis (Clinical Psychologist in Training)
Department of Psychological Medicine
Gartnavel Royal Hospital
1055 Great Western Road
GLASGOW
G12 OXH

Dear Ms Inglis

P16/99 Pre School children with ADHD naturalistic assessment of activity and sleep

Thank you for forwarding your amendments as requested to the Yorkhill Ethics Committee.

The above proposal has been approved.

We wish you good luck with your project.

With kind regards.

Yours sincerely

for Dr B Holland
Secretary Yorkhill Research Ethics Committee

PROFESSOR FORRESTER COCKBURN C.B.E. (CHAIRMAN) KEN THOMSON (CHIEF EXECUTIVE)
YORKHILL, GLASGOW G3 8SJ. Tel: (RHSC) 0141-201 0000 (QMH) 0141-201 0550

Direct Line: 0141 842 7266
Karen Harkins
Direct Fax: 0141 842 7308

Your Ref:

Our Ref: LREC 34/99

Date: 5th May 1999

Ms Stephanie J Inglis
Clinical Psychologist in Training
C/o Panda Centre
Hawkhead Hospital
PAISLEY

Dear Ms Inglis

PRE-SCHOOL CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER – A NATURALISTIC ASSESSMENT OF ACTIVITY AND SLEEP

Thank you for submitting the Protocol for the above study.

The Argyll and Clyde Local Research Ethics Committee considered your request at its meeting on 5th May 1999. I can confirm that there is no objection on ethical grounds to the proposed study and I write to give you our approval to proceed on the understanding that:-

a. All patients recruited to the Study will be interviewed by the Clinician responsible for the conduct of the trial or a member of the Clinical Team who will obtain consent. This will not be delegated to an external agency.

b. You will notify the Medical Director of any hospital whose facilities you may use during the conduct of the Study.

c. You submit a progress report to this Committee one year from the date of this letter.

In reaching the decision, the following documents were reviewed:-

Application Form
Protocol, dated April 1999
Assessment Interview
Symptoms Checklist
Sleep and Activity Diary
Patient Consent Form
Patient Information Sheet
Conners Parent Rating Scale
Conners Teacher Rating Scale
Pre-school Behaviour Checklist

LOCAL RESEARCH ETHICS COMMITTEE
\\ARGYLL\VOL2\COMMON\NURSING\KHARKINS\ETHICS\LETTERS\MAY99\MSSIL.DOC
Ross House, Hawkhead Road, Paisley PA2 7BN
Tel: 0141 842 7200 Fax: 0141 848 1414

5:94 Print Dept.

A list of Committee Members present on the above date is appended.

Yours sincerely

Karen Harkins

J.J. Morrice F.R.C.S.
Chairman

e-mail: enquiries@aapct.scot.nhs.uk

Ayrshire and Arran
Primary Care NHS Trust

CHILD HEALTH DEPARTMENT
Ayrshire Central Hospital
IRVINE KA12 8SS
Direct Line: 01294 323488

BB/IDS

23 December 1999

Ms Stephanie J Inglis
Clinical Psychologist in Training
Department of Psychological Medicine
Gartnaval Hospital
1055 Great Western Road
Glasgow G12

Dear Ms Inglis

Re; Pre-School Children with Attention Deficit Hyperactivity Disorder

I refer to your letter of 15th November 1999, with enclosures addressed to Aileen Bates.

I write to advise you that the Primary Care Trust Ethics Committee, at its meeting on 9th December, considered the proposal, and had no objections to involving Ayrshire patients, provided the conditions imposed by other Ethics Committee are followed, and that controls are chosen only from nursery schools as stipulated by Yorkhill.

I hope you find this helps your study to proceed.

Your sincerely

Ian D. Smith
Directorate Co-ordinator

Appendix 4.

Instructions on the use of the actigraph.

THE ACTIGRAPH

The actigraph is a small monitor that looks like a wrist watch and measures moment by moment motion. The actigraph is waterproof, it can be worn whilst washing and showering but should be removed for swimming.

Instructions for Use

- Attach the actigraph on the wrist of your child's left hand (right hand if your child writes with his/her left hand).

- The actigraph should be worn continuously during the day and during sleep for the duration of the recording period.

- The actigraph has a small indentation on the black face (a small circle). This 'button' **does not** start or stop the actigraph recording, it simply marks or highlights important times during the recording. As children have been found to press this often and at random this will not be used to mark, for example, the time of rising and bedtime. Instead, you have been asked to record important times on your diary sheet.

- Please remember to complete your diary sheet as accurately as possible during the time of recording.

Users name_____

This actigraph is set to begin recording

on_____ at_____

and will record continuously for **three days and three nights.**

Thank you for taking part in this study.