Early Onset of Conduct Problems: Predictors, Pathways and Prevention

by
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Abstract
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The early onset of disruptive, externalizing behaviour symptoms is associated with an increased risk for serious and persistent conduct disorder and antisocial behaviour. This link, along with the limited evidence that established cases of conduct disorder and antisocial behaviour can be effectively treated, argues for the provision of prevention interventions as early as possible. Theoretical arguments in support of early intervention are strong and some evidence exists that early intervention does in fact reduce the risk of conduct disorder in adolescence and adulthood. However, there is a need for further empirical evaluations of new and better interventions that take advantage of advances in our understanding of underlying mechanisms and risk and protective factors.

The design of successful prevention interventions depends upon the validity of the assumptions upon which they are based. This thesis focuses on two questions that constitute prerequisites for the design of early interventions to prevent conduct disorder. The first question concerns risk assessment, that is whether children at risk for later clinically significant conduct problems can be accurately identified in kindergarten and grade one based on the presence of externalizing behaviour symptoms. The second question concerns whether academic achievement and familial functioning factors that are present in kindergarten and grade one children increase risk for conduct disorder. Both questions are addressed in a prospective, followup study, using a random sample of kindergarten and grade one children derived from the Helping Children Adjust: A Tri - Ministry Study.

a) Predicting Conduct Problems: Can High - Risk Children Be Identified in Kindergarten and Grade One?

Targeted interventions, which focus on high - risk children in non - clinic populations are an attractive approach to early intervention. When compared to clinical services, targeted approaches have the potential to increase the coverage and population health impact of the interventions provided by mental health professionals. When compared to universal programmes, targeted approaches are more efficient because only children in need receive the intervention rather than all children. However, their success depends upon an accurate method of identifying high - risk children. Externalizing behaviour symptoms (EBS) are regarded by many as the single best predictor of future conduct disorder. It has been proposed that, even in non - clinic populations of children as young as four and five years of age, 50 percent or more of those with troublesome EBS will develop persistent conduct problems.

The aim of this study was to evaluate the predictive accuracy of EBS and to draw conclusions about their usefulness as a risk assessment method for targeted interventions in kindergarten and grade one children. A critical review revealed that very few studies have addressed the predictive accuracy of EBS. Estimates of sensitivity and positive predictive value derived from existing studies suggested that under the low prevalence conditions that prevail in non - clinic populations of kindergarten and grade one children, the predictive accuracy of EBS may be significantly below the level that has been proposed. In the present study, the predictive accuracy of EBS alone, and in combination with other risk factors was investigated in a non - clinic sample of kindergarten and grade one children derived from the Helping Children Adjust: A Tri - Ministry Study. In contrast to most existing studies, where the definition of high - risk is

based on a single criterion, namely, the presence of externalizing symptoms defined as a symptom score above a pre - specified, arbitrary value, the present study used an approach derived from logistic regression and receiver operating characteristic (ROC) curve techniques. Linear predictors of the logarithm of the odds of conduct problems 30 months later were created and the sensitivity and specificity of the full range of predicted probabilities were evaluated using ROC curve techniques. The sensitivity and positive predictive value of EBS alone for conduct problems 30 months later were below pre-set criteria of ≥ 50 percent for each. Sensitivity and positive predictive value increased when other child (gender, reading achievement) and familial risk factors (income, maternal depression, parenting practices, social support, family functioning) were combined with EBS, but remained below 50 percent.

The results of the logistic regression analyses are consistent with the review of existing studies and suggest that the predictive accuracy of EBS in young children has been over - estimated. As a result, the effectiveness and efficiency of targeted intervention strategies to prevent conduct disorder will be diminished when kindergarten and grade one children are selected to participate based on the presence of EBS. The low sensitivity denies children in need an intervention they might benefit from and reduces population health impact due to low coverage. The low positive predictive value results in wasted resources and exposes children unnecessarily to the negative effects of labeling.

b) Do Academic Achievement and Familial Factors Increase Risk for Conduct Disorder in Normal Populations of Kindergarten and Grade One Children?

Decisions about the content of early prevention interventions are derived from our understanding of causal mechanisms and the specific risk and protective factors that operate in young children. The aim of this study was to

evaluate a set of possible risk factors that can be addressed in skill - based interventions for kindergarten and grade one children, namely reading and arithmetic achievement, maternal depression symptoms, family functioning, parenting practices and social support. Very few studies exist that assess these factors in kindergarten and grade one children and relate them, in a longitudinal design to future outcomes. Moreover, the usefulness of studies that do address these factors is weakened because a risk index composed of multiple factors is used to predict future conduct problems or antisocial behaviour. Consequently, the risk associated with individual factors that are amenable to intervention, such as maternal depression, parenting practices, family functioning or social support cannot be discerned.

Logistic regression was used to evaluate the relationship between the six risk factors and future conduct problems in a non - clinic sample of kindergarten and grade one children derived from the Helping Children Adjust Study. In analyses conducted using the full sample of children, the results showed that reading and arithmetic achievement variables predicted both teacher - and parent - identified conduct problems. However, for the familial functioning variables the results were informant - specific. Maternal depression and social support predicted teacher - identified outcomes, but not parent - identified outcomes. Family functioning and parenting practices did not predict teacher identified outcomes and there was little or no support for their relationship with parent - identified outcomes.

The six risk factors were also evaluated in subgroups defined by the presence (early onset) or absence (later onset) of high levels of EBS at the baseline and six month assessment. For teacher - identified conduct problems, a pattern of results emerged wherein outcome was influenced in the later onset group, but

not in the early onset group. Four of the six risk factors (reading and arithmetic achievement, maternal depression symptoms and social support) influenced the likelihood of outcome in the later onset group but only one of them (reading achievement) influenced the likelihood of outcome in the early onset group. This pattern was not evident in the results for parent - identified outcomes. Achievement variables influenced parent - identified outcomes in both the early and later onset group, but there was little or no support for the influence of any of the familial functioning variables on parent - identified outcomes in either group.

The design of this study does not allow definitive conclusions to be drawn about causal relationships. However, the findings provide support for a potential causal link between conduct problems and academic achievement, maternal depression symptoms and social support. The findings also provide several guides to early intervention planning. Interventions in kindergarten and grade one that target academic achievement, maternal depression symptoms and maternal social support may reduce risk for teacher - identified, clinically important conduct problems. Academic achievement interventions may also reduce the risk for parent - identified conduct problems. Little or no support was found for a relationship between the study outcome and parenting practices or family functioning for either teacher - or parent - identified outcomes, but this may be due to the measures used in the study. Finally, when the intervention target is teacher - identified conduct problems, children who are already experiencing significant levels of EBS (early onset group) may require additional interventions, given that none of the familial functioning variables examined predicted conduct problems in this group.

In conclusion, the epidemiologic analyses presented in this thesis offer

encouragement for the role of early intervention in the prevention of conduct disorder and antisocial behaviour. However, the results suggest that the effectiveness of targeted interventions in kindergarten and grade one children will be significantly enhanced by further research to create more accurate methods of risk assessment. Decisions about the content of early prevention interventions need to take into account that the relationship between risk factors and outcome may be informant - specific and that at least two subgroups of children with different intervention needs may exist among non - clinic populations of kindergarten and grade one children.

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Chapter 1
Introduction

1.1 The Problem

1.1.1 Aggression and Antisocial Behaviour.

Most would agree that the creation of new and better solutions to the problem of aggression and antisocial behaviour is a priority in contemporary society. Yet there is substantial disagreement about the nature of the problem and how society should respond. Fears that the incidence and severity of aggression and antisocial behaviour are worsening among today's youth are expressed regularly in both the professional and lay press (Achenbach & Howell, 1993; Prosser & McArdle, 1996; Onstad, 1997). For example, claims have been made that an epidemic of youth violence is upon us based on crime-rate statistics that show a steady and dramatic increase in antisocial behaviour over the past 50 years (Moffitt, 1993; Yoshikawa, 1994; Guerra, Huesmann, Tolan, Van Acker & Eron, 1995; Tolan, Guerra & Kendall, 1995; Coie, 1996). However, at the same time it is argued that media bias and sensationalism are distorting the true magnitude and nature of the problem and it has been shown that at least some of the perceived increase in youth crime and violence is an artifact of changes in the way crime statistics are reported (Doob & Meen, 1993; Onstad, 1997).

Views about how society should respond are polarized. Some argue for an increased emphasis on 'get tough' strategies that focus on the perpetrators. For example, the 1994 Angus Reid poll reported that 92 percent of Canadians are in favour of amending the Young Offenders Act so it is easier for adolescents to be tried in adult court; 89 percent support boot camps for young offenders (Onstad, 1997). In contrast, others argue that more severe punishment will have little or no effect and cite evidence of past failures with this approach (Henggeler, 1989; Zigler, Taussig & Black, 1992). This alternative perspective contends that

aggression and antisocial behaviour are unavoidable, but not intractable social problems. The cause of the problem is seen to be rooted in an interaction between individual and environmental characteristics. Whether or not individual predispositions are expressed depends upon the socio - economic, political, cultural, familial and peer group influences that exist in the environment. Consequently, a given context may either moderate or exacerbate the onset and persistence of aggression and antisocial behaviour. Prevalence and severity depend ultimately upon the balance (or inbalance) that exists between those factors that increase risk for and protect against aggression and antisocial behaviour (Institute of Medicine, 1994).

Careful research is an essential element in the process of creating effective policies and programmes to address aggression and antisocial behaviour. To this end, this thesis focuses on two questions related to early intervention strategies to prevent the development of clinically important conduct problems. Both questions constitute pre-requisites for the design of successful prevention interventions and thereby reflect important components of the prevention intervention research cycle (Reiss & Price, 1996). One question concerns risk assessment, that is whether children at - risk for later clinically significant conduct problems can be accurately identified in kindergarten and grade one based on the presence of externalizing behaviour symptoms. The other question concerns risk factors for the early onset of conduct problems. Academic achievement and familial functioning variables will be examined.

1.1.2 Conduct Problems

1.1.2.1 Definition

Aggression, violence, externalizing behaviours, antisocial behaviour, conduct disorder, conduct problems, delinquency and criminality are all terms used by researchers to describe the human phenomenon of inflicting harm of

various kinds on other humans or their personal property. In general, antisocial behaviour is viewed as an umbrella concept that covers the full range of legal and illegal, overt and covert behaviours implied by these terms (Yoshikawa, 1994; Tolan, Guerra & Kendall, 1995; Lynam, 1996). Conduct disorder is the psychiatric term for antisocial behaviour and reflects the presence of a psychiatric diagnosis defined using Diagnostic and Statistical Manual (DSM) criteria (American Psychiatric Association, DSM - IV, 1994; see also DSM - III, 1980 & DSM - IIIR, 1987). These criteria include the following dimensions: the number of diagnostic criteria (that is, antisocial symptoms) that must be met; the age of onset of symptoms; the minimum duration of symptoms; the severity of symptoms; the social, academic or occupational impairment caused by the symptoms; and the presence of an overall pattern of symptoms (Jensen, 1996).

The outcome of interest in this thesis is the occurrence of clinically important conduct problems in children under 10 years of age. The definition and measurement of conduct problems will be derived from the DSM criteria for the externalizing disorders which include oppositional defiant disorder (ODD), conduct disorder (CD) and attention-deficit hyperactivity disorder (ADHD) symptoms and measures of impairment (American Psychiatric Association, DSM - III, 1980; DSM - IIIR, 1987; DSM - IV, 1994). Accordingly, the approach taken is consistent with psychiatric definitions of externalizing disorder, but the presence of conduct problems does not imply a psychiatric diagnosis. This is because of the low prevalence of outcome that results when clinical thresholds and psychiatric definitions of conduct disorder are applied in non - referred populations children under 10 years. The childhood internalizing disorders, which include major depressive disorder, overanxious disorder and separation anxiety (American Psychiatric Association, DSM - IV, 1994) are not considered in this thesis.

1.2.2.2 Prevalence and Burden of Illness

Substantial data is available from epidemiologic studies showing that the prevalence and burden of illness associated with psychiatric disorders in children and adolescents is significant. The prevalence of one or more disorders is between 17 and 22 percent in general population studies of 4 - to 16 - year-olds (Costello, 1989; Brandenburg, Friedman & Silver, 1990). These rates are considered to reflect moderate to severe levels of disorder. When only severe disorder is considered the prevalence of one or more disorders is lower, possibly in the range of 7 percent (Brandenburg, Friedman & Silver, 1990).

Table 1.1 shows prevalence rates for individual diagnoses collected in six different epidemiologic studies; details of the assessment methods used and populations studied are shown in the table (Costello, 1989). As can be seen, prevalence rates for one or more disorders are consistent across studies using different methods and different populations. The prevalence of the externalizing disorders is higher than the prevalence of the internalizing disorders. For the externalizing disorders, the prevalence of CD varies from 1.5 percent to 5.5 percent and the prevalence of ADHD varies from 2.2 percent to 9.9 percent. The prevalence of ODD varies from 6.6 to 9.5 percent (Costello, 1989).

The burden of illness associated with conduct disorder and antisocial behaviour is signficant. Up to 50 percent of children seen in clinic settings have conduct disorder symptoms (Kazdin, 1987). Moreover, conduct disorder and antisocial behaviour are known to be associated with a wide range of undesirable psychosocial outcomes including substance abuse, poor school performance and school drop-out, teen pregnancy, depression in females, unemployment, injuries, partner violence and poor physical and reproductive health (Offord, 1989a; Institute of Medicine, 1994; Offord & Bennett, 1994). Overall, the psycho - social and economic impact of conduct disorder and antisocial behaviour on the

Table 1.1
Prevalence of Child and Adolescent Psychiatric Disorder

Author	Andersen et al.	Bird et al.	Velez et al.	Costello et al.	Offord et al.
Informants	Child (Interview) Parent (Checklist) Teacher (Checklist)	Child (Interview) Parent (Interview)	Child (Interview) Parent (Interview)	Child (Interview) Parent (Interview)	Child (Checklist) Parent (Checklist) Teacher (Checklist)
Sample Size	N = 782	N = 777	N = 776	N = 789	N = 2,679
Age Range	Age 11	Age 4 -16	Age 11-20	Age 7-11	Age 4 -16
Attention deficit disorder (w/wo hyperactivity)	6.7	9.9	4.3	2.2	6.2
Oppositional disorder	5.7	9.5	6.6	6.6	NA
Conduct Disorders (all types)	3.4	1.5	5.4	2.6	5.5
Separation anxiety	3.5	4.7	5.4	4.1	
Over-anxious disorder	2.9	NA	2.7	4.6	9.9**
Simple phobia	2.4	2.3	NA	9.2	
Depression, dysthymia	1.8	5.9	1.7†	2.0	
Functional enuresis	NA	4.7	NA	4.4	NA
One or more diagnoses	17.6	18.0 ± 3.4	17.7	22.0 ± 3.4	18.1

* From Costello, 1989

** "Emotional disorder"
† "Major depression"

affected individual and those in the environment in which they live is substantial.

1.1.3 Need for Effective Interventions to Prevent Conduct Disorder

This section establishes the broader context for the thesis, namely the prevention of conduct disorder through the provision of early intervention programmes to non - referred populations of children. The concepts of primary, secondary and tertiary prevention are reviewed. Then, the intervention framework adopted in the mental health field, namely universal, targeted and clinical intervention programmes is presented. The limitations of clinical treatment for established cases of conduct disorder and antisocial behaviour are reviewed and the role of targeted and universal programmes is summarized. This is followed by a review of the evidence that argues for the provision of interventions as early as possible to prevent conduct disorder.

1.1.3.1 Primary, Secondary and Tertiary Prevention

Prevention efforts are defined as either primary, secondary or tertiary in nature (Offord, 1987a; Offord, 1989a; Institute of Medicine, 1994). Primary prevention targets healthy individuals and aims to prevent the occurrence of disease or disorder. Secondary prevention targets individuals who have the disease or disorder and concerns treatment aimed at reducing prevalence and/or severity. Tertiary prevention targets those who have the disorder and concerns palliation and the prevention of secondary conditions.

The underlyling logic of prevention interventions is that a causal chain or mechanism exists that leads to the onset and persistence of disorder and to the development of secondary conditions (Rose, 1992). Prevention interventions aim to break the causal chain or disturb the underlying causal mechanism in a way that leads to a reduction in the incidence, prevalence and/or severity of the disorder and the occurrence of secondary conditions. Accordingly, the content,

timing and target population for prevention interventions are derived from our understanding of underlying causal chains and mechanisms.

1.1.3.2 Universal, Targeted and Clinical Intervention Programmes

The distinction between primary, secondary and tertiary prevention is blurred in the case of behavioural and psychiatric disorders because definitions of the presence of symptoms and disorder are arbitrary (Offord, 1989a). As a result, a unifying framework for the interventions provided by mental health professionals has been formulated and consists of three approaches (Figure 1.1) – clinical, targeted and universal interventions (Gordon, 1983; Institute of Medicine, 1994; Tolan, Guerra & Kendall, 1995; Offord, Kraemer, Kazdin, Jensen & Harrington, 1997). Clinical services are provided to children and their families who seek care from medical, social and community services. In contrast, targeted programmes are offered to non - referred subgroups of children in the population who are determined to be at high - risk for the development of clinically important, mental health problems. Universal programmes are offered to all children in the population, independent of risk.

1.1.3.3 Clinical Services: Limited Impact of Treating Established Cases

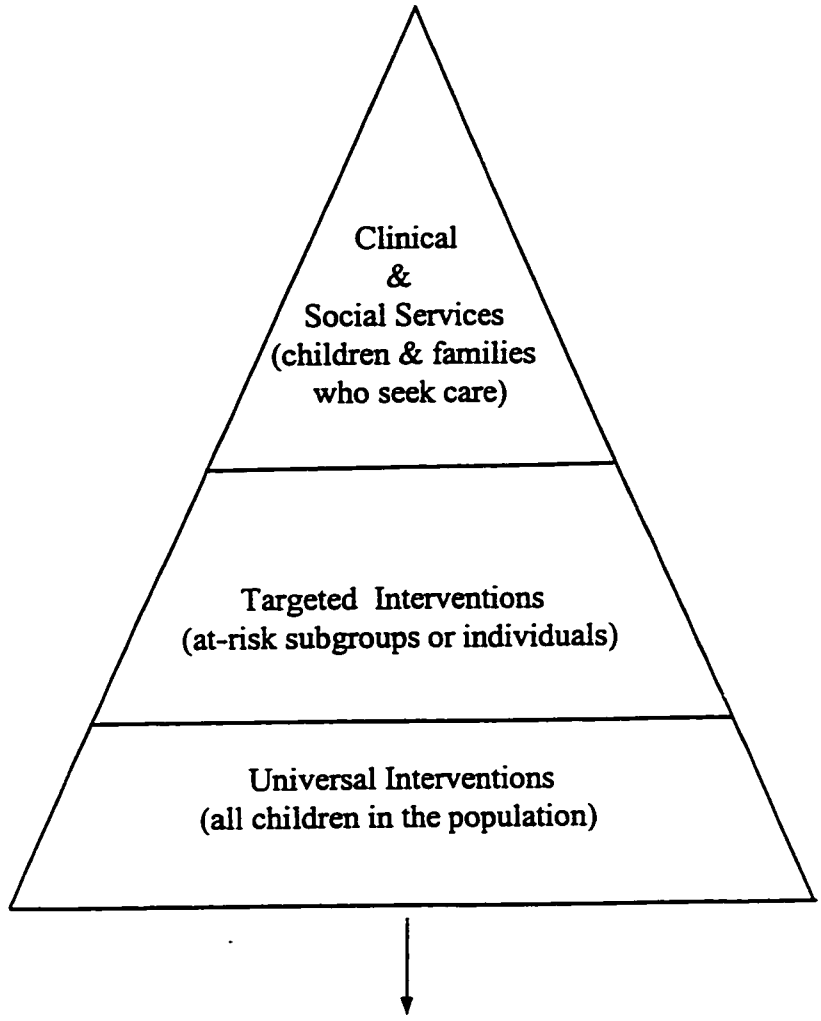
The population health impact of clinical services is limited for two reasons – low coverage and limited effectiveness. Less than 20 percent of children in need of care utilize available services (Offord et al., 1987b; Institute of Medicine, 1994) and it is unlikely that sufficient clinical resources could ever be made available to meet the needs of all those children in need. Moreover, evidence for the effectiveness of interventions offered in clinical settings is scarce, particularly for long - term outcomes (Institute of Medicine, 1994). Clinical treatment strategies for established cases of conduct disorder and antisocial behaviour are aimed at the child and family and include cognitive - behavioural/problem solving skills, parent - management training and functional family therapy. The

evidence for their effectiveness is limited particularly with respect to long - term outcomes (Offord & Bennett, 1994; Kazdin, 1997). One factor that limits effectiveness is compliance by those families most in need of help. In many cases, the parents and families of the most severely disabled children are not able to participate in treatment because of low intelligence levels, substance abuse, psychopathology or other crises related to family and economic circumstances. Tailoring the treatment strategy for parents and families who are suffering from multiple stressors may lead to improved compliance and treatment results but very little research is available on methods to deal with the problem of poor treatment uptake and ways to address non-compliance due to parental dysfunction.

1.1.3.4 Targeted and Universal Approaches: Potential Advantages

Targeted and universal programmes offered to non - referred populations have an important role to play in addressing the mental health needs of children and adolescents. They complement clinical services because they focus on the provision of preventive interventions and provide strategies to increase the coverage and population health impact of mental health services for children and adolescents. Targeted interventions offer at least two important advantages when compared to clinical services and universal programmes. First, in contrast to clinical services, targeted approaches aim to identify all high - risk children in the population and to offer them an intervention from which they might benefit. The result is an increase in coverage of children in need beyond those who seek care and accordingly, an increase in the population health impact of the interventions provided by mental health practitioners. When compared to universal programmes, targeted programmes are a more efficient way to allocate available resources. Only those children in the population who need the

Figure 1.1
Clinical, Targeted and Universal Programmes



. maximize coverage of children in need
. balance between prevention and treatment

intervention receive it rather than all children, as is the case with universal programmes. Consequently, because a smaller number of children receive the intervention, a greater proportion of the available resources can be focused on a given child resulting in a more intensive intervention.

However, the advantages of targeted approaches can only be achieved if an accurate risk assessment method is available to classify children into high - and low - risk groups (Institute of Medicine, 1994; Coie, 1996). If many children who need the intervention are missed (false negatives) the result is poor coverage and a reduction in the public health impact of the intervention. If many children who receive the intervention have little or no need for it (false positives), the result is unnecessary exposure to the negative effects of labeling and wasted resources. As is discussed in the introduction to Chapter 3, little or no discussion of this issue has occurred in the literature to date.

Universal programmes have a role to play in the absence of accurate methods to detect high - risk children. This approach ensures that all children in need of the intervention receive it and avoids the risks associated with labeling. Universal programmes are also required for programmes deemed to be needed by all children and in cases where the effectiveness of a programme depends upon the active particpation of all members of a population, for example school - and classroom - wide social skills training. A major disadvantage of universal programmes is that the available resources are likely to be spread quite thinly because of the large number of children who receive a given intervention. In addition, compared to targeted programmes that are smaller in scale, sustained high levels of programme fidelity may be difficult to maintain because of the large number of people involved in the implementation and receipt of universal programmes.

1.1.3.5 Early Intervention to Prevent Conduct Disorder

A renaissance of interest in the potential for early intervention to prevent conduct disorder has occurred in recent years (Zigler, Taussig & Black, 1992; Reid, 1993; Yoshikawa, 1994; Coie, 1996). This interest stems from recent research findings in four areas. The first concerns long - term effects of early intervention programmes. Early intervention received wide attention in North America beginning with the War on Poverty and the Great Society movement in the US in the 1960's (Gettinger, 1995; Zigler & Berman, 1983). Head Start and other similar programmes provided preschool education and family support, through regular home visits to three - and four - year - old American children living in poverty. The key principles underlying this approach were the notion of critical periods in development and the primacy of intelligence and education as determinants of a successful life - course. The aim was to prevent early school failure and thereby improve the life chances of these high - risk children. However, evaluations conducted in the late 1960's reported that early IQ and academic achievement gains were lost upon entry to primary school. Despite the narrow focus of the evaluations and an over - reliance on outcomes defined in terms of IQ and achievement scores, it was concluded that interventions in children under the age of six were unlikely to be worthwhile: 'compensatory education has been tried and it apparently has failed' (Jensen, 1969).

However, long-term follow-up of 'model' programmes using rigourous research designs, most notably the Perry Preschool intervention project have shown that academic progress and other important outcomes related to antisocial behaviour and its risk factors are modified by interventions provided to young children (Lazar & Darlington, 1982; Zigler, Taussig & Black, 1992; Schweinhart, Barnes & Weikart, 1993). At age 19, compared to a randomized control group, three - and four - year - old poor black children who participated in the Perry

Preschool programme had lower rates of grade retention and use of special education, and higher rates of high school completion and employment. Moreover, crime records showed that only 31 percent of the intervention group had been arrested or charged with a crime, compared to 51 percent of the control group. The total number of arrests in the control group was twice as high as in the intervention group. The mechanism of action of this type of intervention has been argued to be related to increased school readiness in the children which caused higher rates of successful integration into school. Increased parent involvement in their child's development due to the home visit component of the programme is also argued to have contributed to child outcomes through improved parental nurturing skills.

Some caution is warranted in the interpretation of these results. Although impressive effects have been noted in 'model' programmes like the Perry Preschool project, most traditional Head Start programmes have been implemented under routine conditions and similar effects have not been shown (Haskins, 1989). In addition, the children who participated in the model programmes were selected to be at extremely high risk and the numbers of children in the studies is small (Zigler, Taussig & Black, 1992; Yoshikawa, 1994). These caveats point to the need for further evidence gathered in representative populations of children under more standard 'field conditions'. Finally, despite important differences between groups, the rates of negative outcomes in the intervention group are still high and suggest that more is needed to reduce the rates of these outcomes to a more acceptable level.

The findings of longitudinal followup studies also argue for the early provision of interventions to prevent conduct disorder. These studies show that when troublesome, externalizing behaviours are present in childhood there is an increased risk for persistent, life - long psychosocial problems (Olweus, 1979;

Loeber, 1982; Loeber & Dishion, 1983; Farrington, 1990; White, Moffitt, Earls, Robins & Silva, 1990; Moffitt, 1993; Yoshikawa, 1994; Lynam, 1996). For example, the early onset of externalizing behaviours is associated with an increased risk for later conduct disorder, delinquency and substance abuse (Robins, 1978; Farrington, 1990; White, Moffitt, Earls, Robins & Silva, 1990; Tremblay, Pihl, Vitaro & Dobkin, 1994; Caspi, Moffitt, Newman & Silva, 1996; Zoccolillo, Tremblay & Vitaro, 1996). The presence of antisocial behaviour in adulthood 'virtually requires' antisocial behaviour to be present in childhood (Robins, 1978; Moffitt, 1993). Consequently, the presence of externalizing behaviour symptoms is regarded by many as the single best predictor of risk for future conduct disorder and antisocial behaviour. It has been argued that even in non - clinic populations of children as young as four - and five - years - of - age as many as 50 percent or more of those with troublesome, externalizing symptoms will develop persistent behavioural and social maladjustment that includes psychiatric disorder and continues throughout adolescence and adulthood (Reid & Patterson, 1991; Reid, 1993; Campbell, 1995; Coie, 1996).

The outcome of conduct problems that develop early constrasts sharply with that for adolescent onset and it has been suggested that a different set of underlying mechanisms may be operating (Moffitt, 1993). A large increase in the prevalence of antisocial behaviours occurs during adolescence, with a peak at around age 17. Because of their high prevalence, these behaviours are often argued to be 'normative' during this period of development. The available data shows that rates of serious antisocial behaviour decline dramatically after age 17 and that the rise in rates is due to an increase in the number of individuals who engage in antisocial behaviours, not the number of antisocial behaviours committed by a single individual (Farrington, 1983).

Third, new research findings over the past two decades in support of the multi-factorial nature of conduct problems and antisocial behaviour have also contributed to renewed interest in early intervention (Institute of Medicine, 1994). These studies are particularly important because they underline the need to intervene in multiple contexts simultaneously in order to successfully influence the development of antisocial behaviour and/or its associated risk factors (Reid, 1993). Individual, parent and family, peer, school and community factors have been associated with conduct problems and antisocial behaviour and studies showing the person - environment correlations and person - environment interactions that are a necessary condition for their development are now available (Institute of Medicine, 1994; Reiss & Price, 1996).

Fourth, recent studies have increased our understanding of the cognitive and social skills of children with aggressive, externalizing behaviours and of the influence of parent - child interactions on the onset and persistence of aggression and antisocial behaviour. These studies have resulted in the development of new intervention strategies that focus on skill enhancement of the child and parents (other than child academic skills) and these interventions have potential for inclusion in early intervention programmes. For example, disruptive, antisocial behaviour is associated with deficits in problem-solving skills, perceptions, self-statements and attributions (Dodge, Murphy & Buchsbaum, 1984; Dodge, 1986; Schneider, 1989). Aggressive children are more likely to interpret the intentions and actions of others as hostile and to have poor social relations with peers, teachers and parents. Aggressive children are also deficient with respect to their behavioural response repertoire; they identify fewer solutions to interpersonal problems and include physical force and aggression in their solutions more often when compared to nondisruptive children (Dodge,1986; Schneider, 1989). Social skills training programmes have been formulated based on these findings but to

date they have been applied primarily as treatments in selected populations of symptomatic children and families. For example, Bierman developed a social skills training programme for aggressive, rejected children and demonstrated its effectiveness in improving peer relations and acceptance in a randomized trial (Bierman & Furman, 1984). However, effects on modifying aggressive behaviour and treatment outcome are less clear (Offord & Bennett, 1994; Kazdin, 1997). The overall approach has been developed further as a method for promoting prosocial competence that can be administered in community settings and field testing is currently underway (Hundert, 1995; Bierman, 1996).

The influence of parent - child interactions on the development of antisocial behaviour has been shown by Patterson (1982). These studies, which are based on observations of children and their families, show that coercive child behaviour toward the parent results in the parent rewarding aggressive behaviour and thereby inadvertently sustaining undesirable antisocial behaviours (Patterson, 1982; Patterson, 1986; Patterson, DeBaryshe & Ramsey, 1989). Parent - management training has been derived from these findings and has been shown to be an effective treatment in clinical settings for symptomatic children. Modified formats that include the use of self-administered videotapes and group administration methods (Webster - Stratton, 1994) as well as community - based programmes for parents (Cunningham, Bremner & Boyle, 1995) are available, but further research is needed to establish their effectiveness in preventing the onset of clinically important conduct problems in non - referred populations of children (Kazdin, 1997).

1.1.3.6 Summary

The longterm outcomes of model early intervention preschool programmes suggest that it may be possible to influence outcomes and risk factors for conduct problems and antisocial behaviour in a positive way through

early intervention strategies. However, the populations included in these studies have been small in number and of extremely high risk. Consequently, the results are of uncertain generalizability to general population samples (Haskins, 1989). In addition, the interventions tested were composed of academic skills and family support through home - visits. Skill areas such as parenting and social skills were not addressed.

Longitudinal studies show that the early onset of externalizing behaviour symptoms are a strong predictor of future conduct disorder and antisocial behaviour. Moreover, the prognosis for persistent psychosocial problems is much worse when the onset of externalizing symptoms is early as opposed to late (Moffitt, 1993). These findings argue for the provision of prevention interventions as early as possible.

The promising results of the early intervention studies combined with more recent knowledge about longterm outcomes, risk factors and underlying mechanisms can be exploited in further experimental intervention studies in non-referred, representative populations of children that test a broad range of early intervention strategies to prevent conduct disorder. Only two such studies are known. One is an evaluation of a targeted approach to the prevention of conduct disorder which is offered for six years beginning in kindergarten. However, the results will not be available for some time (Reid, 1993). The other is the Helping Children Adjust - A Tri- Ministry Study which was designed to evaluate the effect of universal programmes (social skills and reading partners offered singly and in combination) in kindergarten through grade three (Boyle et al., submitted - a; Boyle et al., submitted - b). The results are not yet published, but the main analysis showed only small to moderate effects on some of the behavioural outcomes (Hundert et al., submitted). No comprehensive review of studies that have evaluated the effectiveness of universal and/or targeted interventions to

prevent the early onset of conduct disorder in young children is currently available, primarily because many of the studies are just becoming available in the literature.

1.1.4 Prevention Intervention Planning: The Empirical Basis

As is evident from the foregoing, the design of prevention interventions is based on a number of assumptions. In the case of early intervention to prevent conduct disorder, the first question concerns *who* should be the target of intervention. That is, whether sub-groups of high-risk children can be accurately identified and should be the focus. The second question addresses *what and when*, that is, the content of an intervention at a given age or developmental stage. However, relatively few prospective, population - based studies are available that address these questions in kindergarten and grade one children. The goal of this thesis is to take an evidence - based approach to intervention design by providing new knowledge about: i) the accuracy of risk assessment; and ii) the evidence in support of focusing the content of interventions in this age group on academic achievement and family functioning risk factors.

1.2 Thesis Overview

This section presents an overview of the two studies that make up this thesis. In addition, the host study which provides the data used for the two studies is introduced, namely, Helping Children Adjust - A Tri - Ministry Study.

1.2.1 Predicting Conduct Disorder: Can High - Risk Children Be Identified in Kindergarten and Grade One?

This study (contained in Chapter 3) is concerned with whether children at risk for future conduct disorder and antisocial behaviour, and who might therefore benefit from a targeted prevention intervention, can be identified in kindergarten and grade one based on the presence of externalizing behaviour symptoms, alone and in combination with other child and familial risk factors.

The study is in two parts. First, a detailed review of the literature is presented and estimates of predictive accuracy are derived from existing studies that meet pre - specified methodologic criteria. Then, logistic regression and receiver operating characteristic curve techniques are applied to address the following three questions using data from the Tri- Ministry study:

1. What is the predictive accuracy of teacher - identified externalizing behaviour symptoms in individual kindergarten and grade one children for teacher - identified conduct problems 30 months later?
2. Can predictive accuracy be significantly improved by combining other child and familial risk factors with externalizing behaviour?
3. What are the implications of the findings for the success of targeted interventions in non - clinic populations of kindergarten and grade one children?

The study design is longitudinal and includes three assessments: baseline, six months and 30 months. The study sample is a representative, random sample of all kindergarten and grade one children who were attending the 60 Ontario schools that participated in the Tri - Ministry study. Psychiatric symptom checklist scales, completed by the teacher, are used to assess the presence of externalizing behaviour symptoms and conduct problems. Other variables are assessed using teacher and parent reports on self - completed questionnaires.

1.2.2 Do Academic Achievement and Familial Factors Increase Risk for Conduct Disorder in Normal Populations of Kindergarten and Grade One Children?

This study is concerned with risk factors that might be the target of skill - based interventions for kindergarten and grade one children. The specific factors to be investigated are academic acehivement (reading and arithmetic) and

familial functioning (maternal depression symptoms, family functioning, parenting practices and social support). Three questions are addressed:

1. Do academic achievement and familial functioning variables that are present in kindergarten or grade one increase the risk for future conduct problems?
2. Do the academic achievement and familial functioning variables have the same relationship to outcome in subgroups of children defined in terms of early and later onset of conduct problem symptoms?
3. Do the study findings depend on whether parent - or teacher - identified symptoms are used to define outcome?

The study design is longitudinal with assessments at baseline, six, 18 and 30 months. The study sample is a representative, random sample of kindergarten and grade one children derived from the Helping Children Adjust: A Tri - Ministry Study. The risk factor variables will be determined at baseline. The study outcome, conduct problems is defined as a pathway and is derived from the six, 18 and 30 month followup assessments. The Wide Range Achievement Test and parent reports are used to assess the risk factors. Psychiatric symptom scales are used to determine the presence of conduct problems. Logistic regression is used to determine the strength of the relationship between the academic achievement and family functioning variables and the study outcome.

1.2.3 Host Study: Helping Children Adjust - A Tri - Ministry Study.

Both studies will be carried out using data from the Helping Children Adjust - A Tri - Ministry Study. The Tri - Ministry study was conducted by the Centre for Studies of Children at Risk, Hamilton Health Sciences Corporation and focuses on the behavioral adjustment of kindergarten to grade three children. The study sample, design, methods, and the data set that was created for use in this thesis are presented in the next chapter.

Chapter 2
Host Study

2.1 Introduction

This chapter has two objectives. The first is to present a summary of the Tri-Ministry study objectives and methods. The second is to describe the sub - sample of kindergarten and grade one children that will be used in the two studies that make up this thesis.

2.2 Tri-Ministry Study Background and Objectives

The Tri-Ministry study was initiated by the Ministries of Education, Health and Social Services in the Province of Ontario to address concerns about rising levels of aggression and violence in schools. The objective was to conduct a community-based randomized trial to evaluate the impact of three types of universal intervention strategies, namely social skills training, parent management training and reading partners on behavioural adjustment in children in kindergarten through to grade three (Boyle et al., submitted - a).

2.3 Study Design

This section describes the study design, the methods used to select children within each school for the detailed assessments required to evaluate the effects of the study interventions and the schedule of followup assessments.

2.3.1 Study Population and Sampling Strategy

Sixty schools, drawn from 11 of the 168 school boards in the province of Ontario participated. Random selection of school boards and schools was not feasible and it was not possible to standardize the screening and selection process for school boards or schools within boards. The methods used to select first school boards and then schools within each board were as follows. First, the Ministry of Education selected 11 of the 168 school boards based on the following characteristics: three boards in metropolitan, multi-cultural communities; three

boards in smaller metropolitan communities that include urban and suburban communities; three boards in rural communities; one French-speaking board; and one board in Northern Ontario.

Second, within a single school board the selection of individual schools to participate was made by that board according to the following criteria: high-risk for behavioural maladjustment based on rates of student suspensions, service referrals and school vandalism when this information was available; and consent of the principal. A comparison of schools within boards indicated that in each board the participating schools had higher levels of disruptive behaviours than the non-participating schools.

2.3.2 Randomization and Study Interventions

The sixty participating schools (n = 60 in total) were randomly allocated to intervention or control status. Those schools randomized to intervention were subsequently randomized to one of four intervention packages comprised of social skills training, parent management training or reading partners offered singly or in combination.

Because it was necessary to offer all 60 schools one of the interventions by the conclusion of the five year study period, in the first year 11 schools were randomized to intervention status and 49 remained control schools. In year two, 11 of the 49 year one control schools were randomly selected to be intervention schools and so on until all control schools had received at least one of the four possible intervention packages.

2.3.3 Risk Assessment and Selection of Children for Assessment

It was not feasible or necessary to carry out the study measurements on every child in each participating school. Therefore, within each school, children were selected for detailed follow-up assessment in a two-stage, random sampling process. First, in each school, a simple random sample of all children in

kindergarten through grade three was selected. Then a brief, risk-screening questionnaire (RSQ) was completed for each child by the parent and teacher. The RSQ consisted of a 16 item externalizing scale and an 11 item internalizing scale (Appendix 1). Each item was scored on a three point scale: zero (never or not true), one (sometimes or somewhat true) or two (often or very true). High - risk was defined as the top 15 percent of scores on either the externalizing or internalizing scales of the screening instrument as reported by either the parent or teacher. Therefore, up to 30 percent of the children could be classified as high risk by either the teacher or parent. High - and low - risk children where then randomly sampled in a ratio of two to one within the strata of externalizing only, internalizing only or externalizing and internalizing balancing for parent and teacher source. Hence, a stratified random sample of children was generated in preparation for the study baseline assessment.

The study assessments were conducted as follows, with the maximum number for a given child dependent on the year of enrollment: baseline (September of the enrollment year); 6 months post - baseline; and then annually thereafter (18, 30 and 42 months). Section 2.4 provides details of the specific variables assessed and measurement methods used.

2.3.4 Study Flow Diagramme

Figure 2.1 shows a flow diagramme of the study design and sampling methods. At step one, eleven school boards and 60 schools were selected. At step two, the sixty schools were randomized to intervention or control status. Randomization occurred yearly in the fall of 1991, 1992, 1993 and 1994. As described above, in year one eleven of the sixty schools were randomized to intervention status and 49 schools served as control schools. In year two, eleven additional schools were selected at random from the 49 control schools to become intervention schools etc.

Step three consisted of risk assessment and selection of children for detailed baseline and followup assessments. In all, four cohorts of kindergarten through grade three children were assessed and enrolled in each of September 1991, 1992, 1993 and 1994. In total, in the four years of enrollment, 10,486 children in kindergarten and grade one were eligible (based on school lists) to be selected at random for risk screening and detailed baseline and followup assessments. A simple random sample of 5446 (96%) of these children completed the risk screening step. The major reason for sample loss at this step was refusal (146/217). A simple random sample, stratified for high - and low - risk status was then selected for detailed baseline and followup assessments (step 4).

The analyses conducted in this study use a data set derived from the cohorts enrolled in 1991, 1992 and 1993. The 1994 cohort is not used because the data was not available at the time the thesis was being prepared. Among the 5446 kindergarten and grade one children who completed the risk screening step (step 3), 1254 children in the 1991, 1992 and 1993 cohorts were selected at random (stratified for high - and low - risk) for detailed baseline and followup assessments (step 4). Further details regarding the sample for this thesis are given below in section 2.6.

2.4 Study Assessments

The Tri-Ministry study included a comprehensive set of assessments in the following areas: i) child functioning; ii) parent and family functioning; iii) socio-demographics; and iv) living circumstances, utilization of services and school characteristics. The assessment methods included: i) parent-reports based on self-complete and interviewer administered questionnaires; ii) teacher-reports based on self-complete questionnaires; and iii) observations in the home and school context carried out by trained observers. The specific variables assessed

Figure 2.1
Study Flow Diagramme

STEP 1
Identification of Schools
60 Schools from 11 School Boards in Ontario

⇓

STEP 2
Randomization of Schools
⇓ ⇓
Intervention Control

⇓

STEP 3
Selection of Children for Risk Screening &
Baseline and Followup Assessments
⇓
Random sample of all children in Kindergarten through Grade 3 in each School.
(Cohort 1 - 1991; Cohort 2 - 1992; Cohort 3 - 1993; Cohort 4 - 1995)
⇓
Risk-screen Questionnaire (RSQ):
Classification as High - or Low - risk
⇓
Stratified Random Sample for Detailed Study Assessments
(2 high - to 1 low - risk child in each school)

⇓

STEP 4
Baseline and Followup Assessments
⇓
Baseline Assessment: October, Year 1
⇓
6 Month Assessment: April, Year 1
⇓
18 Month Assessment: April, Year 2
⇓
30 Month Assessment: April, Year 3

in each area and the methods used to conduct the measurement are shown in Table 2.1 and summarized below. The purpose is to provide a brief overview. The specific variables and measures selected for use in the Prediction and Pathways Study are discussed in detail in chapters three and four.

2.4.1 Child functioning

The primary measure of child functioning was psychiatric symptoms. These were assessed using the revised Ontario Child Health Study Scales (OCHS - R) which are self - complete, symptom checklist scales (Boyle et al., 1987; Boyle et al., 1992). Parent, teacher and child report (ages 11 or older) versions are available. The OCHS - R scales are designed to assess six DSM - IIIR disorders: conduct disorder, oppositional defiant disorder, attention-deficit hyperactivity disorder, overanxious disorder, separation anxiety and depression. A detailed discussion of the content of the scales and their measurement properties is contained in chapter three. Other variables measured include reading and arithmetic achievement which were assessed using the Wide Range Achievement Test (WRAT), school progress (parent and teacher reports), self-esteem assessed using the Harter Scale (interviewer administered), problems getting along with parents, teachers and peers (parent report), physical health (parent report), social skills assessed using the Gresham and Elliot scale (parent report) and class-room and school-yard observations of aggressive behaviour (naturalistic observation).

2.4.2 Parent and Family Functioning

Measures of parent and family functioning included maternal depression, family dysfunction, parenting practices and presence of social supports. The scales used to assess these variables are noted in Table 2.1 and will be discussed in detail in chapter three. Socio-demographic variables were assessed using parent report and included income, welfare status, family structure, education and employment status.

Table 2.1
Tri-Ministry Study: Summary of Variables Measured and Assessment Methods

Area & Variables	Source*	Description and Reference
1. Child Functioning		
a) Child Health	Parent report	General health, chronic medical illness and functional limitations. Cadman et al., 1986.
b) Child psychopathology	Parent and teacher reports	Ontario Child Health Study Scales - Revised (OCHS-R). Externalizing disorder: conduct disorder, oppositional defiant disorder, attention-deficit hyperactivity disorder; Internalizing disorder: over anxious disorder, depression, separation anxiety. Boyle et al., 1993.
	Parent report	Home Situations Questionnaire. Ratings of potentially problematic behaviour. Barkley & Edelbrock, 1987.
c) Social skills	Parent and teacher reports	Gresham & Elliott Scales. Ratings of cooperation, assertion, responsibility and self-control. Gresham & Elliott, 1990.

* Parent report: Interviewer administered or self - complete questionnaire.
Teacher and Principal report: Self-complete questionnaire.

Table 2.1 (cont'd)
Tri-Ministry Study: Summary of Variables Measured & Assessment Methods

Areas & Variables	Source	Description and Reference
c) Social Skills (cont'd)	Parent report	Patterns and frequency of social interactions; how well child gets along with parents, teachers, peers. Centre for Studies of Children at Risk.
	Child	The Pictorial Scale of Perceived Competence and Acceptance. Child's perception of scholastic and athletic competence, social and physical acceptance behaviour, conduct and global self-worth. Harter et al., 1981.
d) Reading achievement	Child	Letter and word recognition, arithmetic skills. WRAT-R, Jastak & Wilkinson, 1984; SORT-R, Slosson, 1990.
	Parent and teacher report	Reading attitudes checklist. Centre for Studies of Children at Risk.
	Parent report	Reading habits at home. Centre for Studies of Children at Risk.
e) Playground behaviour	Observer	Ollendick et al., 1991.
f) Classroom behaviour	Observer	Stanley & Greenwood, 1981.

Table 2.1 (cont'd)
Tri-Ministry Study: Summary of Variables Measured & Assessment Methods

Area & Variables	Source	Description and Reference
g) Parent-child interaction	Observer	Centre for Studies of Children at Risk.
h) Extracurricular activities	Parent report	Participation in non-school organized activities, TV watching. Centre for Studies of Children at Risk.
i) Academic functioning	Parent and teacher report	Ratings of academic progress. Centre for Studies of children at Risk.
2. Parent and Family Functioning		
a) Maternal Depression	Parent report	Centre for Epidemiologic Studies Depression Scale. Radloff, 1977.
b) Parenting Practices	Parent report	FAST Track Parenting Practices Scale. Lochman, 1995.
c) Social Support	Parent report	Social Provisions Scale. Cutrona & Russell, 1987.
d) Family Functioning	Parent report	General Functioning Sub-scale, McMaster Family Assessment Device. Byles et al., 1988.

Table 2.1 (cont'd)
Tri-Ministry Study: Summary of Variables Measured & Assessment Methods

3. Sociodemographic Variables a) family composition b) living circumstances c) parental age d) parental education e) employment f) family income g) receipt of government benefits h) perception of neighbourhood	Parent report	Centre for Studies of Children at Risk.
4) Utilization of Services	Parent report	Use of specialized mental health services and community resources. Centre for Studies of Children at Risk
5. School Characteristics	Teacher reports Principal reports	a) Rating of school atmosphere b) Rating of school-wide discipline c) Rating of level of school-wide behaviour d) Rating of level of class-wide behaviour (teachers only) e) Rating of confidence in classroom management skills (teachers only) f) Rating on teacher/principal morale (teachers and principals) Centre for Studies of Children at Risk.

For completeness, Table 2.1 also summarizes the assessment methods used for utilization of services, satisfaction with living circumstances and school characteristics; these variables are not included in the thesis studies.

2.5 Results of the Main Study

As described above, the main study was designed as a randomized trial. The main analysis showed only small to moderate effects on some of the behavioural outcomes (Hundert J et al., submitted). The intervention and control groups are collapsed into one group for the purposes of the studies conducted here.

2.6 Sub-sample for Thesis

2.6.1 Eligibility Criteria

A subsample of the Tri-Ministry study sample was created to conduct the studies in this thesis. All children in cohorts one (1991), two (1992) and three (1993) who were in kindergarten (junior or senior kindergarten) or grade one at study enrollment (baseline) were eligible for the studies proposed. This provides a prospective, followup study with up to four assessments for each eligible child (baseline, six months, 18 months and 30 months).

2.6.2 Sample Size

Table 2.2 shows the total sample size available at each of the four assessments broken down by grade at enrollment. Using the procedure already described above (step 3 in Figure 2.1), 1254 kindergarten and grade one children in cohorts 1, 2 and 3 were randomly selected for detailed study assessments. Following the baseline assessment, 1203 were deemed to be eligible for the study, representing 96 percent of the 1254 eligible children. The reasons for excluding the 51 students dropped at this stage were: moved from the study school (24) ; missed assessment (15) or duplicate child (11). The remaining columns in Table 2.2 show the number of children with assessments complete at 6 months (column

two), 18 months (column three) and 30 months (column four). This complete data set was used to construct the two samples used in this thesis, as discussed in the next section.

2.6.3 Study Samples

Two study samples were created based on the completeness of assessments for each child. Discussion of sample size, number of assessments, length of followup and overall response rate/sample loss is provided below for each sample. Discussion of the characteristics of each sample and a comparison of respondents and non-respondents is included in chapter three for sample one and chapter four for sample 2.

2.6.3.1 Sample One: Prediction Study

Sample one consists of all children who completed the baseline, six month and 30 month followup assessment. As shown in Table 2.3, the sample size is 746, representing a 62 percent response rate. A comparison of respondents (those with complete assessments at baseline, six and 30 months) and non - respondents is contained in chapter 3.

2.6.3.2 Sample Two

Sample two consists of all children who completed the baseline, six, 18 and 30 month followup assessment. As shown in Table 2.3, the sample size is 728 representing a 61 percent response rate. A comparison of respondents (those with complete assessments at baseline, six, 18 and 30 months) and non - respondents is contained in chapter 4.

Table 2.2
Total Sample Size Available

	Assessment				
	Baseline* n(%)		6 Months n(%)	18 Months n(%)	30 Months n(%)
	a	b			
Grade at Enrollment					
Junior Kindergarten	303 (24)	290 (24)	256 (24)	249 (24)	212 (25)
Senior Kindergarten	439 (35)	421 (35)	368 (35)	357 (35)	295 (35)
Grade One	512 (41)	492 (41)	460 (41)	424 (41)	341 (40)
Total	1254	1203**	1064	1030	848

*a = Selected.
b = Assessed and eligible.

** 96 percent of 1254 selected for initial assessment.

Table 2.3
Sample Size: Samples 1 and 2

Grade at Enrollment	Eligible (No.)	Sample* (n, % of Eligible)	
		1	2
Junior Kindergarten	290	183 (63)	178 (61)
Senior Kindergarten	421	259 (62)	254 (60)
Grade One	492	304 (62)	296 (60)
Total N	1203	746 (62)	728 (61)

*Sample 1: Number of children with assessments complete at baseline, six and 30 months of followup.

Sample 2: Number of children with assessments complete at baseline, six, 18 and 30 months of followup.

Chapter 3
Predicting Conduct Problems

3.1 Introduction and Relevance

Disruptive, externalizing behaviour symptoms in childhood are associated with an increased risk for conduct disorder and antisocial behaviour in adolescence and adulthood (Robins, 1978; Loeber, 1982; Loeber & Dishion, 1983; Farrington, 1990; White, Moffitt, Earls, Robins & Silva, 1990; Tremblay, Pihl, Vitaro & Dobkin, 1994; Caspi, Moffitt, Newman & Silva, 1996; Zoccolillo, Tremblay & Vitaro, 1996). This link, along with the limited evidence that conduct disorder and antisocial behaviour can be treated effectively, argues for the provision of preventive interventions as early as possible (Offord, 1989a; Offord & Bennett, 1994; Kazdin, 1997). Targeted interventions, which focus on high - risk children in non - clinic populations are one approach to early intervention and offer several possible advantages (Institute of Medicine, 1994; Tolan, Guerra & Kendall, 1995; Offord, Kraemer, Kazdin, Jensen, & Harrington, 1997). As discussed in chapter one, when compared with clinical interventions, targeted approaches have the potential to increase coverage and population health impact. When compared to universal programmes, targeted approaches are more efficient because only children in need receive the intervention. However, the success of targeted interventions depends upon an accurate method to identify high - risk children. When children are not correctly classified, the impact of the intervention is diminished. False negative classification errors deny children in need the opportunity to receive an intervention from which they might benefit and thus reduce the population health impact of promising preventive interventions. False positive errors result in wasted resources and expose children unnecessarily to the negative effects of labeling (Milich, McAninch & Harris, 1992; McConaughy, 1993).

The present study is concerned with whether children at risk for conduct disorder and antisocial behaviour and who might therefore benefit from a targeted prevention intervention can be identified in kindergarten and grade one based on the presence of externalizing behaviour symptoms. Externalizing symptoms are regarded by many as the single best predictor of risk for future conduct disorder and antisocial behaviour (Loeber, 1991; Moffitt, 1993; Patterson, 1993; Yoshikawa, 1994; Lynam, 1996). It has been suggested that even in non - clinic populations of children as young as four and five years of age, 50 percent or more of those with troublesome, externalizing symptoms will develop persistent conduct problems (Reid & Patterson, 1991; Reid, 1993; Campbell, 1995; Coie, 1996). However, the literature review contained in section 3.3 reveals at least three reasons why further investigation is needed to clarify the predictive accuracy of externalizing behaviour symptoms in non - clinic populations of kindergarten and grade one children, and accordingly, their usefulness as a risk assessment method (Bennett, Lipman, Racine & Offord, 1998a). First, very few appropriately designed studies have been conducted to evaluate the predictive accuracy of externalizing symptoms in this age group and it is difficult to draw conclusions about whether the level of predictive accuracy is sufficient to justify their use as a method to designate high - risk status. Estimates of sensitivity and specificity vary substantially between studies and it is difficult to compare studies because of differences in the methods used.

Second, little or no discussion of the impact of misclassification on the success of targeted interventions has occurred. The available studies suggest that the sensitivity of externalizing behaviour symptoms in non - clinic populations of kindergarten and grade one children is likely to be significantly less than 50 percent (Bennett, Lipman, Racine & Offord, 1998a). Consequently, targeted interventions in this group would miss the majority of children in need of

prevention interventions. Similarly, the existing studies suggest that the specificity of externalizing behaviour symptoms is below the level needed to ensure acceptable false positive rates in populations where the prevalence of outcome is low. For example, in non - clinic populations of kindergarten and grade one children where the prevalence of outcome is 15 percent or less, positive predictive value (PPV) is probably below 50 percent. This means that among the children designated as high - risk the majority will receive an intervention for which they have little or no need and will be unnecessarily placed at risk for the negative effects of labeling.

Third, there is a need to evaluate alternative methods of using externalizing symptoms to determine risk status. To date, most investigators have used a categorical approach to classify children into high - and low - risk groups. Risk is usually based on a single criterion, namely, the presence of externalizing symptoms defined as a symptom score above an arbitrarily defined cut - off value. Alternative approaches have received little attention. Multiple - gating is one exception and consists of multiple, categorically defined criteria to designate high - risk status which are applied in sequence using increasing intensive assessment methods (Loeber, Dishion & Patterson, 1984). One investigator has evaluated the predictive accuracy of this approach in a one year followup study of kindergarten children (Lochman, 1995). The presence of externalizing symptoms (high - risk status) was defined as a symptom score above the designated cut - off on teacher (gate one) and parent - reports (gate two, applied only to the sub - group of children who meet the gate one criterion) of externalizing symptoms. This method improved sensitivity and specificity compared to teacher - report only. However, the levels achieved would still result in significant missclassification of children in populations where the

prevalence of outcome is 15 percent or less. The addition of a third criterion, poor parenting practices (gate three), did not result in additional improvement.

The present study uses logistic regression and receiver operating characteristic (ROC) curve techniques to investigate the predictive accuracy of externalizing behaviour, alone and in combination with other risk factors in non - clinic populations of kindergarten and grade one children. The creation of predictors of conduct problems using logistic regression is an approach to risk assessment that has not been reported to date.

3.2 Background

3.2.1 Identifying High-risk Groups

High-risk groups can be identified based on membership in a group, individual characteristics or a combination of the two. Examples of group membership as the basis for intervention include poor children (Berrueta - Clement, Schweinhart, Barnett, Epstein & Weikart, 1984; Schweinhart, Barnes & Weikart, 1993) and inner-city children (Guerra, Huesmann, Tolan, Van Acher & Eron, 1995). This approach is attractive because it is very simple to execute, the children and families targeted are clearly in need and there is a high yield with respect to the prevalence of risk and likelihood of disorder within the group. Everyone receives the intervention and no one is singled out or labeled in any special way. However, this approach may exclude the majority of the population. For example, poor children or inner-city children make up only a small proportion of the total population. Many other children who are at risk, but fall outside the definition of the risk group targeted will be missed and as a result, the population health impact of the intervention is reduced.

The other approach is to apply a risk assessment method to all individuals in the population. The advantage is the potential to capture all children in need. However, the disadvantage is that, in the absence of a perfect risk assessment

tool, some children will be misclassified. Consequently, it is necessary to assess the trade - offs between the potential gain in coverage of at - risk children and the misclassification rate associated with a particular risk assessment method. The present study addresses risk assessment at the level of the individual and aims to evaluate the magnitude of misclassification found in terms of the implications for targeted interventions programmes.

3.2.2 Study Assumptions

Three assumptions about the purpose of risk assessment guided the approach taken in this study. The first assumption is that risk assessment will be performed in conjunction with a targeted intervention offered in the school setting. The intervention will target child behaviour and academic performance directly (through skill enhancement) and indirectly (through interventions designed to change parent and teacher behaviour). Schools offer an attractive venue for providing interventions to at - risk children and adolescents because of their dominance in child life and high coverage of the population. However, for the most part, high-risk children are spread across schools. Therefore, if the goal is to offer targeted interventions to all children who might benefit, an accurate method to identify high - risk individuals is a necessary pre-requisite. The second assumption is that the primary impact of the intervention is expected to be on child outcomes that occur in the school setting, namely conduct problems. The third assumption is that the risk assessment method must be composed of existing measures that are feasible, affordable and acceptable in non-referred, general population samples of kindergarten and grade one children.

3.2.3 Risk Assessment Based on the Presence of Externalizing Behaviour Symptoms

Two approaches to risk assessment based on the presence of externalizing behaviour symptoms in kindergarten or grade one will be evaluated. The first

approach is based on the presence of externalizing behaviour symptoms alone. The second approach combines the presence of externalizing behaviour symptoms with other child and familial risk factors (academic achievement; gender; socio-economic disadvantage; and familial functioning). The two approaches are designed to serve both practical and scientific purposes. In terms of practicality, both are derived from currently available measures that are feasible for use in general populations of children. The difference between them is the amount and type of risk information required. Hence practical questions are addressed regarding: i) how much information is needed to optimize the accuracy of risk assessment in this age group; and ii) the trade-offs between gains in predictive accuracy and the effort involved in obtaining specific risk information.

Regarding the scientific purpose, the overall goal of the study is to clarify the predictive accuracy of externalizing behaviour symptoms in non - referred populations of kindergarten and grade one children. 'Looking back' from adolescence and adulthood consistently shows that problem behaviour is evident from an early age in individuals with conduct disorder and antisocial personality disorder (Robins, 1978). However, conduct problems are relatively common in non-referred samples of four - and five - year-old children (Thomas, Byrne, Offord & Boyle, 1991). Consequently, 'looking forward' in kindergarten and grade one, the predictive value of these behaviours is less clear. The present study challenges current thinking by presenting: i) a critical summary of existing studies that provide information about the predictive accuracy of externalizing behaviours in kindergarten and grade one; and ii) new findings about their predictive accuracy using logistic regression and receiver operating characteristic curve (ROC) techniques and a data set derived from the Helping Children Adjust - A Tri-Ministry Study.

3.3 Predictive Accuracy

3.3.1 Prediction

The Oxford dictionary defines 'predict' as follows: to make a statement about the future, foretell, prophesy. Predictive accuracy is concerned with conditional probabilities. That is, given the presence of a known characteristic in an individual, what is the likelihood that the individual possesses, or will possess in the future, another characteristic that is currently unknown. The objective of the present study is to derive probability estimates of future conduct problems in individual kindergarten and grade one children based on the presence of externalizing behaviour symptoms alone and in combination with other child and familial risk factors.

3.3.2 Predictive Accuracy

The utility or predictive accuracy of a predictor (or test result) is evaluated in terms of five characteristics as shown in Figure 3.1 (Meehl & Rosen, 1955; Galen & Gambino, 1975; Sackett, Haynes, Guyatt & Tugwell, 1991; Kraemer, 1992):

i) sensitivity, that is the proportion of individuals with the outcome in whom the predictor is present (a/a+c);

ii) specificity, that is the proportion of individuals without the outcome in whom the predictor was not present (d/b+d);

iii) positive predictive value, that is the proportion of those with the predictor who develop the outcome (a/a+b);

iv) negative predictive value, that is the proportion of those without the predictor who do not develop the outcome (d/c+d);

v) accuracy, that is the proportion of individuals classified correctly (a+d)/(a+b+c+d).

Figure 3.1
Predictive Accuracy

		Outcome	
		Present	Absent
Predictor	Present	a	b
	Absent	c	d

Sensitivity = a / a + c
Specificity = d / b + d
Positive Predictive Value = a / a + b
Negative Predictive Value = d / c + d
Accuracy = a + d / a + b + c + d
Prevalence = a + c / a + b + c + d

Sensitivity and specificity can be assumed to be stable across populations when three assumptions hold. The first assumption is that the case mix of the population is comparable in terms of the spectrum of disease severity from mild to severe (Ransahoff & Feinstein, 1978; Kraemer, 1992). If this assumption does not hold, it is possible that sensitivity and specificity will vary. The second assumption concerns whether or not a gold standard exists that can be used to assess the presence of the outcome or disease. When a gold standard is not available and sensitivity and specificity are determined using a fallible criterion of 'truth' (subject to error) then estimates of sensitivity and specificity will be influenced by the variability or error inherent in the gold standard. The third assumption concerns the consistency of methods used to assess the predictor and the outcome. Deviations from a standardized method of administration can lead to variations in sensitivity and specificity.

Positive (PPV) and negative predictive value (NPV) vary with the prevalence of disorder, or base rate in the population. Table 3.1 shows the effect of prevalence on PPV and NPV for an instrument with a sensitivity of 80 percent and a specificity of 95 percent. As can be seen, as the base rate varies from one to 50 percent, the positive predictive value increases from 14 to 94.1 percent; negative predictive varies inversely with prevalence from 99.8 to 82.6 percent for the example given.

3.2.3 Strength of Association and Statistical Significance

The assessment of predictive accuracy assumes that: i) the magnitude of association between the predictor and the outcome is important, based on clinical and/or public health criteria; and ii) the association is statistically significant. Odds ratios and risk ratios are ratio measures of the magnitude of association between a predictor and an outcome (Fleiss, 1981; Matthews & Farewell, 1988; Kelsey, Whittemore, Evans & Thompson, 1996). An odds ratio is the ratio of the

Table 3.1
Effect of Prevalence on
Positive and Negative Predictive Values

Sensitivity = 80%
Specificity = 95%

Prevalence (percent)	Positive Predictive Value (%)	Negative Predictive Value (%)
1	14.0	99.8
2	24.6	99.6
3	33.3	99.4
4	40.0	99.1
5	46.0	98.9
6	50.5	98.7
7	54.9	98.4
8	58.2	98.2
9	61.5	98.0
10	64.0	97.7
11	66.7	97.5
12	68.6	97.2
13	70.7	97.0
14	72.3	96.7
15	73.6	96.4
20	80.0	95.0
25	84.4	93.4
50	94.1	82.6

odds of having the disease given the presence of a specific characteristic (a/b) versus having the disease in the absence of the specific characteristic (c/d). A risk ratio, on the other hand is the ratio of the probability of having the disease in a person with a specific characteristic (a/a+b) versus the probability of having the disease in the absence of the specific characteristic (c/c+d). A risk ratio is only appropriate for use in prospective studies that provide an estimate of the probability of outcome. When the risk of disease is small in both the exposed and unexposed groups (under 0.05), then the odds ratio and the risk ratio will be nearly identical (Kelsey, Whittemore, Evans and Thompson, 1996).

Confidence intervals can be calculated for odds ratios and risk ratios and provide the upper and lower bounds for the interval within which the true value falls (or put another way, the values that can be ruled out with 95 percent confidence). When a confidence interval includes one this indicates that the null hypothesis (that is, that no relationship exists between the predictor and outcome) cannot be rejected.

Many different forms of the chi - square test statistic exist (Fleiss, 1981). When the relationship between a predictor and an outcome is presented in a fourfold table like the one shown in Table 3.2, the classic chi - square test (Fleiss, 1981) is calculated and compared with the corresponding distribution of chi - square to determine the probability associated with the value obtained and hence, whether a statistically significant association is present. The equation for calculating this form of chi-square and the associated degrees of freedom are shown in Table 3.3. The objective is to determine if the observed data deviate from what would be expected if the occurrence of the predictor and the outcome

Table 3.2
Strength of Association

		Outcome	
		Present	Absent
Predictor	Present	a	b
	Absent	c	d

$$\text{Odds Ratio} = \frac{a / b}{c / d} \text{ or } \frac{(a)(d)}{(c)(b)}$$

$$\text{Risk Ratio} = \frac{a / a + b}{c / c + d}$$

Table 3.3
Statistical Significance

		Outcome		
		Present	Absent	
Predictor	Present	n_{11}	n_{12}	$n_{1.}$
	Absent	n_{21}	n_{22}	$n_{2.}$
		$n_{.1}$	$n_{.2}$	$n_{..}$

$$* \chi^2 = \frac{n_{..} (| n_{11}n_{22} - n_{12}n_{21} | - 1/2\, n_{..})^2}{n_{1.}n_{2.}n_{.1}n_{.2}}$$

Degrees of Freedom (df) $= (r - 1)(c - 1) = 1$

* Fleiss, 1981: page 19.

were independent. A statistically significant value of the classic chi-square does not necessarily mean that an important relationship exists in terms of the magnitude of association; it may simply be due to a large sample size.

3.2.4 Prediction, Risk Factors and Causation

In the present study, a 'predictor' is defined as a variable or a combination of variables, assessed concurrently or sequentially over time that is present in kindergarten or grade one and results in an increase in the probability that the outcome will be present at follow-up. It is important to distinguish a predictor from a risk factor because additional scientific criteria are required to designate a variable as a risk factor and to evaluate its possible causal role. The two key distinguishing characteristics are that a risk factor must be: i) conceptually distinct or independent from the outcome; and ii) shown to be present prior to the occurrence of the outcome. Additional scientific criteria are required to assess the putative causal role of a risk factor (Offord, 1987; Sackett, Haynes, Guyatt & Tugwell, 1991; Kelsey, Whittemore, Evans & Thompson, 1996). Although it is possible that a predictor examined in the current study may meet criteria for a risk or causal factor, this is not a necessary characteristic. In the present study, in most cases, the predictors examined will not be conceptually distinct from the outcome because they will contain the same externalizing disorder symptoms used to define the outcome.

3.2.5 Screening and Risk Assessment

Screening is a two-stage process applied to non-referred populations. There are two possible objectives as shown in Figure 3.2. One objective is to detect individuals in the population who currently possess a disorder. The first stage of the process consists of a simple, inexpensive screening tool and the goal is to divide the population into those who have an elevated probability of the presence of the disorder and those who do not. The second stage usually consists

of a full clinical assessment of all positive screenees to identify those who actually possess the disorder. These individuals then become the subject of further intervention. The main characteristic of a screening tool in this application is therefore, sensitivity, that is the extent to which the tool identifies (or captures) all the persons with the target condition among the total population. If it can be assumed that little or no risk is associated with the full clinical assessment, a high specificity (and therefore a low false postive rate) is secondary and the optimal level is directly related to the cost associated with unnecessary clinical assessments due to false positives.

The second, alternative objective of screening is to identify individuals with a high probability of developing an outcome in the future. In this case, individuals who screen positive in stage one are assumed to be at an elevated risk for developing the disorder and are given an intervention (in stage two) designed to reduce the probability that the outcome will occur. Hence, in this case, the purpose of screening becomes risk assessment and the predictive validity of a positive screening result becomes a central criterion in determining the usefulness of the screening tool.

This study is concerned with risk assessment. Sensitivity and specificity are deemed to be of equal importance. A high sensitivity is needed to ensure that as many at - risk children who might benefit from a preventive intervention as possible are detected. A high specificity is also needed to obtain a low false positive rate and thereby minimize the effects of labeling and the potential for wasting intervention resources on children with little or no need for them.

3.3.6 Empirical Approaches to Risk Assessment in Individuals

3.3.6.1 Methods Used to Date

A simple, categorical approach has been used by most investigators to identify children at high - risk for future clinically significant conduct problems.

Figure 3.2
Screening and Risk Identification

Screening Tool
⇓

Conduct Disorder
Symptoms
(Checklist Report)

⇓ ⇓

	Current Status of Individual	Future Status of Individual
STEP 1:	Screening Target · Individuals with a high likelihood disorder is present now Test Characteristics: · Sensitivity: High proportion of those with disorder screen positive.	Screening Target · Individuals with a high likelihood of disorder in the future Test Characteristics: · Positive Predictive Value: High proportion of those who screen positive will possess disorder in the future. · Sensitivity: High proportion of those who will develop disorder in the future screen positive.
STEP 2:	Full clinical work-up to confirm presence of disorder followed by intervention.	Intervention based on probability that disorder will develop.

As will be seen in the literature review in section 3.4, risk is usually based on a single criterion, namely, the presence of externalizing symptoms defined as a symptom scale score above an arbitrarily defined cut - off value. As was noted in section 3.1, with the exception of one study that evaluated the multiple gating technique, little or no attention has been given to alternative approaches to using the presence of externalizing symptoms to predict risk for conduct problems.

3.3.6.2 Logistic Regression and Receiver Operating Curve Techniques

This study will use logistic regression and receiver operating characteristic (ROC) curve techniques to create and evaluate linear predictors of the logarithm of the odds of the study outcome, conduct problems. This approach is attractive for a number of reasons. First, logistic regression allows the prediction of a binary outcome, in this case the presence or absence of conduct problems. Second, this approach maximizes the use of the information contained in a continuously scaled predictor variable because there is no need to collapse possible scores into categories. Third, logistic regression allows two or more predictor variables to be combined into a predictive index using generalized linear modeling techniques. The predictor variables can be either discrete or continuous. Fourth, ROC curve techniques can be used to identify the optimal cut - point on the scale of values provided by the predictive index.

3.4 Literature Review

3.4.1 Introduction

As stated above, externalizing behaviour symptoms are regarded by many as the single best predictor of risk for future conduct disorder and antisocial behaviour with some authors suggesting that, even in non - clinic populations of children as young as four and five years of age, 50 percent of those with troublesome, externalizing symptoms will develop persistent problems (Reid & Patterson, 1991; Reid, 1993; Campbell, 1995; Coie, 1996). The purpose of the

review that follows is to critically evaluate existing studies of the predictive accuracy of externalizing behaviours in the kindergarten to grade one age group. The outcome of interest is conduct disorder and antisocial behaviour. Estimates of predictive accuracy need to be derived from studies that provide unbiased estimates of the probability of later outcomes. Studies that are relevant to the question posed here must be conducted in representative samples of non - referred, kindergarten and grade one children who are followed up prospectively to determine the occurrence of later outcomes.

3.4.2 Methods

The methods used to identify eligible studies, assess their methodological quality and determine predictive accuracy are as follows.

3.4.2.1 Study Eligibility Criteria

Studies were eligible to be included if they met the following criteria: i) representative, non-referred sample of children; ii) at least one assessment of externalizing behaviour in the kindergarten to grade one age range and at least one follow-up assessment to determine the presence of conduct disorder or antisocial behaviour.

3.4.2.2 Search Strategy

Articles were located using the following search strategy: systematic searching of Medline, PsychInfo and ERIC; review of the bibliographies of relevant published reports; personal file drawer search; and consultation with colleagues and experts in the field.

3.4.2.3 Study Methodological Quality

Study quality can influence estimates of predictive accuracy. Accordingly, all eligible studies were assessed using the following methodologic criteria. *Sample Characteristics*: First, a representative sample should be generated through random selection of individuals from the target population. Second, 80

percent or greater sample completeness should be achieved to minimize bias due to non-random sample loss.

Predictors and Outcome: First, the presence of the predictor and outcome should be assessed using a standardized method applied to all study subjects. Second, evidence of the reliability and validity of the measures used should be provided. Third, the source or informant should be specified. Fourth, the content of the predictor and outcome should be specific to externalizing behaviour symptoms. Fifth, the methods used to assess the predictor should be feasible, affordable and acceptable with respect to their application in non-referred populations of kindergarten and grade one children.

Statistical Analysis: First, the association between the predictor and the outcome should be statistically significant. Second, confidence intervals should be provided.

3.4.2.4 Predictive Accuracy

Sensitivity, specificity, positive and negative predictive value, accuracy and outcome prevalence were either abstracted directly from studies or calculated when the necessary data was included in the article but not presented in the form required by this review.

3.4.2.5 Definition of Predictors and Outcomes

Substantial heterogeneity was found between studies in the definition and assessment of the predictor and the outcome. Therefore, it was impractical to set precise definitions for either. The minimum requirement was that a study classified participants with respect to externalizing behaviour symptoms at time t and time t + x and identified the assessment method used, content and informant.

3.4.3 Results

3.4.3.1 Eligible Studies.

Seventeen studies were found that satisfied the eligibility criteria. Table 3.4 summarizes their characteristics in terms of: i) sample size and completeness at followup; and ii) age of the child at the baseline and follow-up assessment. Thirteen of the 17 studies provided information about the predictive accuracy of behaviours that were present in kindergarten and grade one (double asterisk in column one indicates the four studies that did not). Two of the 13 studies explicitly reported their results in terms of sensitivity, specificity, positive and negative predictive values (Lochman, 1995; Lipman, Bennett, Racine and Offord, 1998); the remaining 11 did not, but provided sufficient data to allow the necessary calculations. Duration of follow-up varied from one to seven years.

3.4.3.2 Study Quality

Table 3.5 summarizes the methodological quality for all 17 studies located; the 13 studies that provided estimates of predictive accuracy are indicated in the second row. Ten of the thirteen studies assembled representative populations, but only seven of them achieved followup rates of 80 percent or more. If sample loss is not random and those at highest risk for later antisocial outcomes are lost to followup, estimates of predictive accuracy may be biased. This means that studies with low follow-up rates may under - estimate predictive accuracy.

All 13 studies that provided information about predictive accuracy used rigourously applied, reliable and valid methods to assess behaviour. Eleven of them used behavioural checklists completed by the parent and/or teacher to assess the presence of the predictor and/or outcome. One study assessed early behaviour with teacher reports and later outcomes with youth reports (Tremblay, Pihl, Vitaro & Dobkin, 1994). One study used the Diagnostic Interview Schedule for Children (DISC) to generate computer derived conduct disorder outcome

Table 3.4
Design Characteristics of 17 Studies

1	2		3	
Study (Number, author, year)	**Sample Size** Follow Up N	% of Baseline*	**Age of Child (years)** Baseline	Follow Up
1. Lipman, 1998	356	80	4-5	8-9
2. Verhulst, 1988	263	66	4-5	6-7
**3. McConaughy, 1992	300	80	4-5	7-8
4. Zoccolillo, 1996	1423	63	6	10
5. Stevenson, 1985	458	61	3	8
6. Fischer, 1984	541	43	4	11
7. McGee, 1984	949	92	5	7
8. Lochman, 1995	362	92	5	6
9. Richman, 1982a	98	100	3	8
10. Garrison, 1985	61	61	3	6
11. White, 1990	924	89	5	11
**12. Vitaro, 1991	229	60	5	8
1994	132	60	5	10-11
**13. Tremblay, 1992	147	45	6	14
14. Tremblay, 1994	915	88	6	13
**15. Gagnon, 1995	743	74	6	12
16. Richman, 1982b	185	92	3	8
17. Kohn, 1977	323	<42	3-5	8-10

* Sample completeness at follow up.
** Estimates of predictive accuracy not available.

diagnoses (Zoccolillo, Tremblay & Vitaro, 1996). Eight of the 13 studies used checklist methods that were linked to psychiatric classifications of disorder (American Psychiatric Association, 1980; 1987; 1994) but four of them used checklist scale cut points for the presence of disorder that were validated in older age groups (Richman, Stephenson & Graham, 1982a,b; McGee, Silva & Williams, 1984; Stevenson, Richman & Graham, 1985).

Only seven of the 13 studies reported that a statistical association existed between early behaviour and later outcomes; the remainder did not conduct this analysis. The presence of a statistical association confirms that the rate of occurrence of later antisocial outcomes is greater than chance when early externalizing behaviours are present. If the frequency of antisocial outcomes is not greater than chance, then it does not make sense to derive estimates of the predictive accuracy of early behaviours.

3.3.3.3 Other Study Characteristics That May Influence Predictive Accuracy

Content of the assessment method, the informant, duration of follow - up and gender may also influence estimates of predictive accuracy. Only five of the 13 studies focus on the predictive value of externalizing behaviour alone and consequently, directly address the question posed in this review (Fischer, Rolf, Hasazi & Cummings, 1984; Tremblay, Pihl, Vitaro & Dobkin, 1994; Lochman, 1995; Zoccollillo, Tremblay & Vitaro, 1996; Lipman, Bennett, Racine & Offord, 1998). The remaining studies defined either or both of early behaviour and later outcomes in terms of a total deviance (or problem) score which included externalizing and internalizing symptoms (Richman, Stevenson & Graham, 1982a,b; McGee, Silva & Williams, 1984; Garrison & Earls, 1985; Stevenson, Richman & Graham, 1985; Verhulst & Althaus, 1988; Vitaro, Gagnon & Tremblay, 1991; McConaughy, Stanger & Achenbach, 1992; Vitaro, Tremblay,

Table 3.5
Summary of Study Quality

Study Number**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Estimates of Predictive Accuracy Provided	√	√	x	√	√	√	√	√	√	√	√	x	x	√	x	√	√
Sample																	
. representative	√	√	√	√	√	?	√	√	√	?	√	√	?	√	√	√	?
. follow up ≥80%	√	x	√	x	x	x	√	√	√	x	√	x	x	√	x	√	x
Assessment of Predictor & Outcome																	
. standardized assessment	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
. reliability and validity	√	?	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
. informant specified	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
. predictor- externalizing	√	x	x	√	x	√	x	√	x	x	x	x	x	√	x	x	x
. outcome- externalizing	√	x	x	√	√	√	x	√	√	x	√	x	√	√	x	√	√
. predictor- feasible, affordable, acceptable	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Statistical Analysis																	
. risk increase, p value reported	x	x	√	x	√	√	x	√	√	x	x	x	√	√	√	√	√
. confidence intervals	x	x	√	√	x	x	x	x	x	x	x	x	√	√	√	x	x

* √ = satisfactory; x = unsatisfactory; ? = can't tell.

** See Table 1 for author and year.

& Gagnon, 1994; Gagnon, Craig, Tremblay, Zhou & Vitaro, 1995). Some of these studies also included other behaviours such as troublesome eating and sleeping problems. When estimates of predictive accuracy from the studies that focused on externalizing behaviours alone are compared with the remainder, no obvious differences between the two groups were evident. Although it is possible that predictive accuracy is equivalent in the two groups of studies, the most likely explanation for the apparent similarity is that differences may be masked because the studies within each group differ on other important study characteristics that influence predictive accuracy.

The choice of informant may also influence estimates of predictive accuracy. For example, studies that use the same informant to obtain checklist information about early behaviours and later outcomes would be expected to yield higher levels of predictive accuracy than those that use different informants for each assessment (Achenbach, McConaughy & Howell, 1987). The 13 studies can be classed into three groups based on informant: i) those in which the same informant (for example, parent) was used to assess the presence of early problem behaviours and the occurrence of subsequent outcomes; ii) those in which a different informant was used for each assessment (for example, parent for the assessment of early behaviour and teacher for the assessment of outcome); and iii) those in which the parent and/or teacher provided information on the presence of early externalizing behaviours and subsequent outcomes but the presence of the outcome was determined by a psychiatrist based on parent and teacher reports and/or clinical assessment methods. As can be seen in Tables 3.6, 3.7 and 3.8, when estimates of predictive accuracy are grouped in this way no distinctive between - group differences are apparent. (Tables 3.6, 3.7 and 3.8 will be discussed in detail in the next section.)

The stability of behaviour over short periods of time is greater than over longer periods (Olweus, 1979). Followup varied from one to seven years in the 13 studies, but due to insufficient numbers of studies with different followup periods it was not possible to examine the effect of duration on predictive accuracy.

Finally, gender may influence predictive accuracy. It has been shown that DSM criteria for conduct disorder under-identify females who have important behavioural problems and impaired functioning based on other independent criteria (Zoccolillo, 1993; Zoccolillo, Tremblay & Vitaro, 1996). The majority of the studies reviewed here included both males and females; one study was limited to males only (Tremblay, Pihl, Vitaro & Dobkin, 1994) and one to females only (Zoccholillo, Tremblay & Vitaro, 1996). A few of the studies presented their results separately for each gender but there is insufficient information to draw conclusions about whether sensitivity and specificity vary by gender. Even in the case of a risk indicator that yields equivalent levels of sensitivity and specificity in males and females, the positive predictive value will be higher in males because the prevalence of antisocial behaviour is lower in females (Zoccolillo, 1993).

3.4.3.4 Results for Predictive Accuracy

Ideally, the studies would be grouped using the five study characteristics presented above (study quality, content of behaviour assessment method, informant, duration of followup and gender) in order to create relatively homogeneous subgroups with respect to factors that influence predictive accuracy. However, the number of studies in any given subgroup is too small and therefore informant is used to group the studies. Table 3.6 summarizes studies where the same informant was used for each assessment of behaviour. Table 3.7 shows the studies that used a different informant at each assessment.

Table 3.8 shows the studies that used a psychiatrist to determine the presence of the outcome. Each table includes: i) the duration of followup; ii) the assessment methods used to determine the presence of early externalizing behaviours and later outcomes; iii) the informant at each assessment; iv) whether the measures used were linked to psychiatric classifications of disorder; and v) sensitivity, specificity, positive and negative predictive values and prevalence. Table 3.9 provides an overall summary of the estimates of sensitivity, specificity and positive and negative predictive values contained in Tables 3.6, 3.7and 3.8.

Despite the heterogeniety among studies it is possible to draw some conclusions regarding the predictive accuracy of externalizing behaviours in non-referred populations of kindergarten and grade one children. As can be seen in Table 3.9, there is no obvious pattern or clustering that differentiates the three informant subgroups. Sensitivity varies from 28 to 100 percent (15 estimates) across the 13 studies with almost two-thirds of the estimates at or below the 50 percent mark. It is worth noting (see Tables 3.6, 3.7and 3.8) that the estimates of sensitivity that exceed 60 percent are associated with low levels of specificity. Specificity varies from 58 to 97 percent (14 estimates) across the studies and only exceeds 90 percent in two cases.

As shown in Tables 3.6, 3.7and 3.8, the prevalence varies among the studies from a low of 3 percent to a high of 31 percent and consequently, the individual estimates of PPV and NPV cannot be compared. Therefore, the estimates of sensitivity and specificity contained in Table 6 were used to derive estimates of the level of PPV and NPV that might be achieved under three different prevalence conditions. Based on Table 3.9, it was judged that the sensitivity of early externalizing symptoms is unlikely to exceed 50 percent. Similarly, specificity was judged unlikely to be greater than 90 percent. Table

Table 3.6
Predictive Accuracy: Same Informant

Study (author, year, number)	Followup Interval (years)	Assessment Method: Predictor	Assessment Method: Outcome	Informant: Predictor	Informant: Outcome	Outcome Linked to Psychiatric Classification of Disorder	Predictive Accuracy*: Sen	Spec	PPV	NPV	P
Lochman, 1995 (8)	1	Teacher Observation of Children Revised - Externalizing Symptoms	Authority Problem Scale - Externalizing Symptoms	Teacher	Teacher	No	77	69	40	92	21
Verhulst, 1988 (2)	2	Child Behaviour Checklist - Total Problem Score	Child Behaviour Checklist - Total Problem Score	Parent	Parent	No	-	-	46	-	10
Garrison, 1985 (10)	3	Behaviour Screening Questionnaire - Total Deviance Score	Child Behaviour Checklist - Total Problem Score	Parent	Parent	No	44	87	54	81	26
McConaughy, 1992 (3)	3	Child Behaviour Checklist - Total Problem Score	Child Behaviour Checklist - Total Problem Score	Parent	Parent	No	-	-	-	-	-
Lipman, 1997 (1)	4	Ontario Child Health Study Checklist Scales - Conduct Disorder	Ontario Child Health Study Checklist Scales - Externalizing Disorder	Parent	Parent	Yes- DSM III	55	89	33	95	10
Vitaro, 1991 (12)	3	Social Behaviour Questionnaire - Total Problem Score	Social Behaviour Questionnaire - Total Problem Score	Parent	Parent	No	-	-	-	-	-
Vitaro, 1994 (12) (males only)	5-6			Teacher	Teacher						
Richman, 1982 (16)	5	Behaviour Screening Questionnaire - Total Deviance Score	Rutter Parent and Teacher Scales - Total Deviance Score	Parent	Parent	Yes Pre-DSM III	-	-	43	80	NA
			- Antisocial Score				-	-	21	87	NA
Fischer, 1984 (6)	7	Vermont Behaviour Checklist - Externalizing Score	Child Behaviour Checklist - Externalizing Score	Parent	Parent	No	-	-	41	89	10
Kohn, 1977 (17)	5	Kohn Symptom Checklist - Total Deviance Score	Peterson Problem Checklist - Externalizing Score	Teacher	Teacher	No	-	-	41	-	NA
Gagnon, 1995 (15) (males only)	6	Social Behaviour Questionnaire - Total Problem Score	Social Behaviour Questionnaire - Total Problem Score	Teacher	Teacher Parent	No	-	-	-	-	-

*Sen = sensitivity; Spec = specificity; PPV = positive predictive value; NPV = negative predictive value; P = prevalence; NA = can't calculate.

Table 3.7
Predictive Accuracy: Mixed Informant

Study (author, year, number)	Follow up Interval (years)	Assessment Method Predictor	Assessment Method Outcome	Informant Predictor	Informant Outcome	Outcome Linked to Psychiatric Classification of Disorder	Predictive Accuracy* Sen	Spec	PPV	NPV	P
Lochman, 1995 (8)	1	Teacher Observation of Children Revised, Child Behaviour Checklist, Revised Behaviour Problem Checklist - Externalizing Symptoms	Child Behaviour Checklist (Parent) Authority Problem Scale (Teacher) - Externalizing Problems Score	Parent and Teacher Combined	Parent, Teacher, Parent and Teacher Combined	No	52	85	45	88	21
							51	85	47	87	21
							56	86	53	88	21
				Teacher	Parent, Parent & Teacher Combined		63	65	31	88	21
							73	68	39	90	21
McGee, 1984 (7)	2	Rutter Parent & Teacher Scales - Total Deviance Score	Rutter Parent & Teacher Scales - Total Deviance Score	Parent &/or Teacher	Parent &/or Teacher	Yes Pre-DSM - III	31	-	31	-	31
Stevenson, 1985 (5)	5	Behaviour Screening Questionnaire - Total Deviance Score	Rutter Teacher Scale - Total Deviance Score - Antisocial Score	Parent	Teacher	Yes Pre-DSM - III	32	88	43	82	22
							36	86	23	92	10
Tremblay, 1994 (14) (males only)	7	Social Behaviour Questionnaire • impulsivity, anxiety, reward dependence	Self-reported Delinquency	Teacher	Youth	No	28	97	48	92	10
Tremblay, 1992 (13)	7	Pupil Evaluation Inventory	Self-reported Delinquency Jessness Inventory	Child	Youth	No	-	-	-	-	-

*Sen = sensitivity; Spec = specificity; PPV = positive predictive value; NPV = negative predictive value; P = prevalence

Table 3.8
Predictive Accuracy: Psychiatrist Assessed Outcome

Study (author, year, number)	Followup Interval (years)	Assessment Method		Informant		Outcome Linked to Psychiatric Classification of Disorder	Predictive Accuracy***				
		Predictor	Outcome	Predictor	Outcome		Sen	Spec	PPV	NPV	P
Richman, 1982 (9)*	5	Behaviour Screening Questionnaire - Total Deviance Score	Rutter Parent and Teacher Scales - Total Deviance Score	Parent	Parent Teacher Psychiatrist	Yes Pre-DSM III Psychiatrist Assessment of all Information	36	91	56	81	25
Richman, 1982 (16)**	5	Behaviour Screening Questionnaire - Total Deviance Score	- Total Deviance Score - Antisocial Score	Parent	Parent Teacher Psychiatrist	Yes Pre-DSM III Psychiatrist Assessment of all Information	- -	- -	61 38	78 86	NA NA
Zoccolillo, 1996 (4) (females only)	4	Disruptive, Antisocial Behaviour Scale	Diagnostic Interview Schedule for Children - Conduct Disorder	Parent	Trained Interviewer	Yes DSM III (Computer Algorithm)	100	58	7	100	3
White, 1990 (11)	6	Rutter Parent Scale - Presence of problems	Rutter Parent Scale Rutter Teacher Scale Diagnostic Interview Schedule for Children - Conduct disorder or oppositional defiant disorder or attention deficit disorder	Parent	Parent, Teacher, Child, Psychiatrist	Yes DSM III Psychiatrist Assessment of all Information	64	80	15	97	5

* representative population sample
** high risk - low risk comparison
*** Sen = sensitivity; Spec = specificity; PPV = positive predictive value; NPV = negative predictive value; P = prevalence; NA = can't calculate.

Table 3.9
Summary of Predictive Accuracy

Informant Group	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Same	44, 55, 77	69, 87, 89	21, 33, 40, 41, 41, 43, 46, 54	80, 81, 87, 89, 95
Mixed	28, 31, 32 36, 51, 52, 56, 63, 73	65, 68, 85, 85, 86, 86, 88, 97	23, 31, 31, 43, 45, 47, 48, 53, 61	82, 87, 88, 88, 88, 90, 92, 92
Psychiatrist	36, 64, 100	58, 80, 91	7, 15, 38, 56, 61	78, 81, 86, 97, 100

Table 3.10
Positive and Negative Predictive Values (Estimated)

	Prevalence (%)					
	10		15		50	
	PPV (%)	NPV (%)	PPV (%)	NPV (%)	PPV (%)	NPV (%)
1. Sensitivity 50%						
Specificity 85%	27	94	37	91	77	63
Specificity 90%	36	94	47	91	83	64
2. Sensitivity 45%						
Specificity 85%	25	93	34	90	75	61
Specificity 90%	33	94	44	90	82	62

* PPV = Positive Predictive Value
NPV = Negative Predictive Value

3.10 shows estimates of PPV and NPV based on these 'best - case estimates' of sensitivity and specificity: sensitivity is set at 45 percent or 50 percent; specificity is set at 85 or 90 percent. Values are shown for two levels of prevalence consistent with non-referred populations of children (10 and 15 percent) and for a prevalence of 50 percent, which is consistent with clinical populations (Kazdin, 1987). As can be seen, PPV only exceeds 50 percent under conditions of high prevalence. Under low prevalence conditions PPV is less than 50 percent and varies from a low of 27 percent to a high of 47 percent.

3.4.4 Discussion

Three main conclusions can be drawn from the foregoing review. First, the estimates in Table 3.10 suggest that the predictive accuracy of externalizing behaviour symptoms in normal populations of individual kindergarten and grade one children has been over-estimated. Individual children who seek care in clinical settings may have a high likelihood of later antisocial outcomes when externalizing behaviour symptoms are present, but this is not the case for kindergarten and grade one children in non- referred populations. Among the estimates presented in Table 3.10, those based on a sensitivity of 45 percent, a specificity of 85 percent and a prevalence of 10 percent are probably the most realistic.

Second, the findings of the review suggest that if the presence of early, externalizing behaviour, assessed using currently available measures is used as the criterion to designate kindergarten and grade one children in normal populations as high risk, the level of misclassification will be substantial. In the context of targeted interventions, this results in two important disadvantages. First, at least half of the children at - risk for future conduct disorder or antisocial behaviour will be missed and not receive an intervention from which they might benefit. Second, 50 percent or more of those children who receive the

intervention have little or no need for it and are placed at risk for the negative effects of labeling.

The third conclusion is that little or no attention has been directed at exploring alternative approaches to using externalizing behaviour symptoms to determine risk status. The exception is multiple - gating. Two studies have evaluated this approach and are reviewed below in section 3.5 (August, Realmuto, Crosby & MacDonald, 1995; Lochman, 1995). No investigator has yet evaluated the use of a prediction rule derived using logistic regression methods and multiple measures of risk including behavioural symptoms, other child characteristics, and familial functioning variables.

A final comment concerns the influence of the choice of informant on the identification of high - risk children. Parents and teachers identify different groups of children as high risk (Offord et al., 1996a,b). Moreover, the group of children who have pervasive disorder (that is, identified by both the parent and teacher) is only a small subset of all the children identified by either the parent or teacher. Consequently, a tension is created with respect to which of the three groups of children (parent-identified, teacher-identified or pervasive) should be a priority for identification and participation in intervention programmes. For example, those with pervasive disorder may be at the highest risk for persistent problems in childhood and adolescence and therefore be the highest priority, despite the small number of children included in this group. However, on the other hand, all children with teacher - identified externalizing symptoms would seem to be legitimate targets for programmes offered within the school context given that the goal is to reduce or eliminate maladaptive behaviours that occur in the school setting.

3.5 Multiple Gating

Multiple - gating is a sequential screening method and was designed originally to identify individuals at high risk for delinquency. Two applications are available in the literature, one in juvenile delinquency and one in conduct disorder as summarized below. The approach consists of a series of three sequential assessments called 'gates'. Each successive gate is more expensive to administer than the preceeding one. Only those children who are judged to be positive at the first gate are assessed at the second gate. Similarly only children who are judged to be positive at the second gate proceed to the third. The overall rationale is to provide a cost-effective, accurate method of screening large groups to detect high risk individuals.

3.5.1 Juvenile Delinquency

Loeber, Dishion and Patterson (1984) used multiple - gating to identify adolescent males who were at risk for delinquency. Delinquency was defined as any police contact documented by the juvenile court for non-traffic offenses. Gate one consisted of teacher reports of classroom behaviour. The sub - group of boys who scored above the 47th percentile on the teacher behaviour scale then proceeded to the second gate, a parent telephone interview on conduct problems. All boys who remained above the 47th percentile based on the parent telephone report proceeded to the third gate which consisted of a face-to-face interview with the parents and child about parent monitoring behaviour and child disobedience. Those boys above the 47th percentile on the third gate are deemed 'at - risk' for delinquency. The data available demonstrate the concurrent validity of the method in a sample of 102 seventh and tenth grade males. These males were obtained from 300 families who volunteered to participate from among the 1000 families asked. The representativeness of the 102 boys in relation to the original sample is not known. The criterion for evaluation was existing police

records of delinquency and 14 boys were found to meet this criterion. Based on all three gates, the overall accuracy was 88 percent. Sixty-four percent of all delinquents were detected (sensitivity) and 56 percent of those who screened positive were delinquent (true positive rate). The predictive accuracy of this approach for future delinquency has not been documented.

3.5.2 Conduct Disorder

Two investigators have applied multiple - gating to detect elementary children at high - risk for conduct disorder (August, Realmuto, Crosby & MacDonald, 1995; Lochman, 1995). Both investigators used scales containing externalizing behaviour symptoms at gates one and two and parenting practices at gate three, but the specific scales used by each investigator were not the same (and also differed from those used by Loeber in the delinquency study described above). Teacher reports of behaviour were used at gate one and parent reports at gate 2 by all investigators.

Lochman applied multiple - gating in a sample of 396 kindergarten children and evaluated the predictive accuracy of the resulting risk classification (high or low risk) against categorical outcomes defined as a Child Behaviour Checklist Externalizing Scale t score greater than or equal to 63. Risk was assessed at the end of kindergarten when the multiple - gating was conducted (time one: winter for teacher informant and spring for parent informant). Outcome was assessed at the beginning of grade one (time two: 5 months from time one for parent informant and 7 months from time one for teacher informant) and at the end of grade one (time three: 14 months from time one for teacher informant and 17 months from time one for parent informant). The predictive accuracy of the resulting high risk classification was reported for teacher identified outcomes, parent identified outcomes and outcomes based on parent and teacher reports combined into a single score. Overall, the levels of sensitivity

and specificity found were modest. The highest level of positive predictive value reported (70 percent) was derived by defining the outcome to be present at either the beginning or end of grade one, which resulted in a prevalence of over 30 percent. Applying the sensitivities and specificities found to a situation with an expected prevalence of 15 percent would not yield positive predictive values above 50 percent.

August (1995) applied multiple gating to all children in grade one through four in 22 suburban Minneapolis schools (n = 7231). Multiple regression techniques were used to regress scores at each gate against teacher reported scale scores for ODD and ADHD 18 months later to determine the additional variance explained by each gating step. However, the predictive accuracy of the resulting risk classification (high or low risk) in individual children was not reported.

3.6 Study Questions

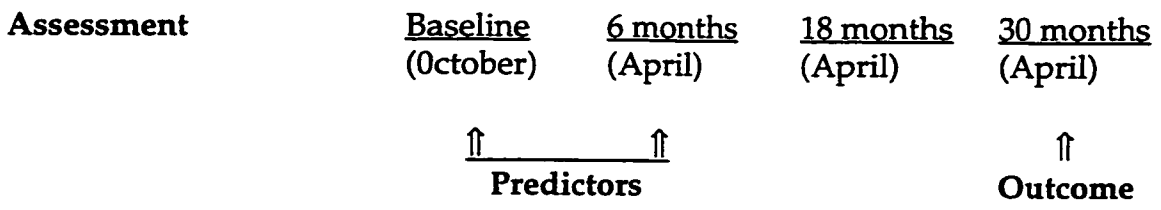
Three questions are addressed in this study using data from the Helping Children Adjust - A Tri - Ministry Study:

1. What is the predictive accuracy of teacher - identified externalizing behaviour symptoms in individual kindergarten and grade one children for teacher-identified conduct problems and poor school performance 30 months later?
2. Can predictive accuracy be significantly improved by combining other risk factors with externalizing behaviour?
3. What are the implications of the findings for the success of targeted interventions in non - clinic populations of kindergarten and grade one children?

3.7 Study Design and Sample Size

A prospective, followup study will be conducted. The study design is shown in Figure 3.3. Predictor variables are evaluated at baseline and at the 6 month followup assessment. The presence of outcome is determined at the 30 month followup assessment.

Figure 3.3
Prediction Study Design



Sample 1, as described in section 2.6.3.1 will be used and consists of all Tri-Ministry participants who: i) were in kindergarten or grade one at the time of enrollment (n = 1203); and ii) completed the baseline, 6 month and 30 month study assessments. Seven hundred and forty - six children met these two criteria.

3.8 Study Outcome

The outcome to be predicted is clinically important conduct problems that are present in the school context. This outcome was selected because it is the primary outcome that targeted interventions offered in the school context are designed to influence. The definition and measurement of conduct problems is derived from DSM - IIIR diagnostic criteria for oppositional defiant disorder and conduct disorder as is discussed below.

The discussion that follows begins with a definition of clinically important conduct problems. This is followed by a presentation of the DSM diagnostic criteria for conduct disorder and oppositional defiant disorder and a summary of alternative approaches to the assessment and measurement of psychiatric disorders. Then, co - morbidity, influence of informant and issues related to determining the presence of disorder are discussed. Following the presentation of this background information, the remainder of this section describes the approach that will be used in this study to define the presence of outcome. The measures available in the Tri - Ministry study to define the presence of clinically important conduct problems are presented and then the rationale for the approach to be taken is presented.

3.8.1 Clinically Important Conduct Problems

As stated in chapter one, the term 'conduct problems' is not intended to imply a psychiatric diagnosis but rather to denote the presence of disruptive, externalizing behaviour symptoms that result in impaired functioning. 'Clinically important' is defined as the level of functioning at which therapeutic

concern arises and change is considered desirable. That is, the problem: i) matters in the present because it is associated with important impairments in function; and ii) is associated with an elevated risk for persistent externalizing behaviour problems and psychiatric disorder in adolescence and adulthood.

3.8.1.1 Diagnostic Criteria: Externalizing Disorders of Childhood

This section presents the DSM diagnostic criteria and rules for determining the presence of conduct disorder, opppositional defiant disorder and attention - deficit hyperactivity disorder. Both DSM - IIIR and DSM - IV criteria are presented because the latter is the most recent version, but the measures available in the Tri - Ministry study were designed using DSM - IIIR criteria.

Conduct disorder (CD) is ' a repetitive and persistent pattern of behaviour in which the basic rights of others or major age-appropriate societal norms or rules are violated' and is defined in terms of three types of behaviour: aggression against others behaviours that result in property loss or damage and serious violation of rules (DSM - IV, 1994). DSM - IIIR and - IV criteria for conduct disorder are shown in Table 3.11. As can be seen, the individual criteria for each version of DSM are not the same. The requirements for diagnosis also differ. In DSM -IIIR, 3 of 13 criteria must be present in the last six months. In DSM - IV, the requirement is 3 of 15 criteria in the last 12 months with at least one criterion present in the last 6 months. Evidence of impairment, attributable to the symptoms, must also be present, for example, poor school performance and/or role function, problems getting along with friends, teachers and family and the need for, or utilization of health and social services. Evidence of impairment is not explicitly required by DSM - IIIR. DSM - IIIR includes 3 types of conduct disorder: i) group type; ii) solitary aggressive type; and iii) undifferentiated type. In contrast, DSM - IV identifies two conduct disorder types based on the age of

Table 3.11
Diagnostic Criteria for Conduct Disorder

DSM - IIIR	DSM - IV
1. Has stolen without confrontation of a victim on more than one occasion (including forgery).	1. Has stolen items of nontrivial value without confronting a victim (e.g., shoplifting, but without breaking and entering; forgery).
2. Has run away from home overnight at least twice while living in parental or parental surrogate home (or once without returning).	2. Has run away from home overnight at least twice while living in parental or parental surrogate home (or once without returning for a lengthy period).
3. Often lies (other than to avoid physical or sexual abuse).	3. Often lies to obtain goods or favours or to avoid obligations (i.e., "cons" others).
4. Has deliberately engaged in fire-setting.	4. Has deliberately engaged in fire-setting with the intention of causing serious damage.
5. Is often truant from school (for older person, absent from work).	5. Is often truant from school, beginning before age 13 years.
6. Has broken into someone else's house, building, or car.	6. Has broken into someone else's house, building, or car.
7. Has deliberately destroyed others' property (other than by fire-setting).	7. Has deliberately destroyed others' property (other than by fire setting).
8. Has been physically cruel to animals.	8 Has been physically cruel to animals.
9. Has forced someone into sexual activity with him or her.	9. Has forced someone into sexual activity.
10. Has used a weapon in more than one fight.	10. Has used a weapon that can cause serious physical harm to others (e.g., a bat, brick, broken bottle, knife, gun).
11. Often initiates physical fights.	11. Often initiates physical fights.

Table 3.11 (Cont'd)
Diagnostic Criteria for Conduct Disorder

12. Has stolen with confrontation of a victim (e.g., mugging, purse-snatching, extortion, armed robbery).	12. Has stolen while confronting a victim (e.g., mugging, purse snatching, extortion, armed robbery).
13. Has been physically cruel to people.	13. Has been physically cruel to people.
	14. Often bullies, threatens, or intimidates others.
	15. Often stays out at night despite parental prohibitions, beginning before age 13 years.

onset (before 10 years of age): i) childhood - onset type; and ii) adolescent - onset type.

Oppositional defiant disorder (ODD) is considered to be a less severe form of conduct disorder (Earls, 1994). Although the symptoms of conduct disorder may overlap with oppositional defiant disorder, the converse is not possible. The defining features are disobedience and non-compliance, that is, ' a recurrent pattern of negativistic, defiant, disobedient and hostile behaviour toward authority figures that persists for at least 6 months (DSM - IV)'. The key symptoms of conduct disorder (aggression against others, destruction of property, lying and deceit) are not present. Table 3.12 shows the DSM - IIIR and - IV diagnostic criteria for ODD. In DSM - IIIR, five of nine symptoms must be present for six months and CD must be absent. Severity ratings include the presence of impairment for moderate and severe disorder. In DSM - IV, four of eight symptoms must be present for 6 months, CD must be absent and social, academic or occupational functioning must be impaired.

Attention - deficit hyperactivity disorder (ADHD) is characterized by inattention, impulsiveness and hyperactivity, that is ' a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of development' (DSM - IV). Table 3.13 shows the DSM - IIIR and - IV diagnostic criteria for this disorder. In DSM - IIIR, presence of disorder is defined as the presence of 8 of the 14 symptoms for 6 months. Onset must be before age 7 and pervasive developmental disorder must be absent. Severity ratings include the presence of impairment for moderate and severe disorder. In DSM - IV, symptoms are divided into two groups: inattention and hyperactivity - implusivity. Disorder is present if: i) six symptoms of either inattention (nine in total) or hyperactivity - impulsivity (nine in total) are present for 6 months in two or more settings;

Table 3.12
Diagnostic Criteria for Oppostional Defiant Disorder

DSM - IIIR	DSM - IV
1. Often loses temper.	1. Often loses temper.
2. Often argues with adults.	2. Often argues with adults.
3. Often actively defies or refuses adult requests or rules, e.g., refuses to do chores at home.	3. Often actively defies or refuses adult requests or rules.
4. Often deliberately does things that annoy other people, e.g., grabs other children's hats.	4. Often deliberately annoys other people.
5. Often blames others for his or her own mistakes.	5. Often blames others for his or her own mistakes.
6. Is often touchy or easily annoyed by others.	6. Is often touchy or easily annoyed by others.
7. Is often angry and resentful.	7. Is often angry and resentful.
8. Is often spiteful or vindictive.	8. Is often spiteful or vindictive.
9. Often swears or uses obscene language.	

Table 3.13
Diagnostic Criteria for Attention-Deficit Hyperactivity Disorder

DSM - IIIR	DSM - IV*
1. Often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness).	1. Often fidgets with hands or feet or squirms in seat. (H)
2. Has difficulty remaining seated when required to do so.	2. Often leaves seat in classroom or in other situations in which remaining seated is expected. (H)
3. Is easily distracted by extraneous stimuli.	3. Is often easily distracted by extraneous stimuli. (A)
4. Has difficulty awaiting turn in games or group situations.	4. Often has difficulty awaiting turn. (I)
5. Often blurts out answers to questions before they have been completed.	5. Often blurts out answers before questions have been completed. (I)
6. Has difficulty following through on instructions from others (not due to oppositional behaviour or failure of comprehension), e.g., fails to finish chores.	6. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behaviour or failure to understand instructions). (A)
7. Has difficulty sustaining attention in tasks or play activities.	7. Often has difficulty sustaining attention in tasks or play activities. (A)
8. Often shifts from one uncompleted activity to another.	8. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework). (A)
9. Has difficulty playing quietly.	9. Often has difficulty playing or engaging in leisure activities quietly. (H)
10. Often talks excessively.	10. Often talks excessively. (H)

Table 3.13 (Cont'd)
Diagnostic Criteria for Attention-Deficit Hyperactivity Disorder

11. Often interrupts or intrudes on others, e.g., butts into other children's games.	11. Often interrupts or intrudes on others (e.g., butts into conversations or games). (I)
12. Often does not seem to listen to what is being said to him or her.	12. Often does not seem to listen when spoken to directly. (A)
13. Often loses things necessary for tasks or activities at school or at home (e.g., toys, pencils, books, assignments).	13. Often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools). (A)
14. Often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), e.g., runs into street without looking.	14. Often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness). (H)
	15. Often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities. (A)
	16. Often has difficulty organizing tasks and activities. (A)
	17. Is often forgetful in daily activities. (A)
	18. Is often "on the go" or often acts as if "driven by a motor." (H)

* H = hyperactivity; I = impulsivity; A = attention.

ii) onset is before age 7; and iii) social, academic or occupational functioning is impaired.

3.8.1.2 Assessment and Measurement Methods

Four methods are available to determine the presence of psychiatric symptoms and disorder: i) clinical psychiatric interviews; ii) structured interviews administered by a clinician or a trained interviewer; iii) symptom checklists completed by the parent, teacher and/or child (if 11 years of age or older); and iv) naturalistic observation. Each of these four approaches is briefly summarized below. Psychiatric symptom checklists completed by the teacher will be used in this study.

Physician - assessed disorder is often viewed as the gold standard for determining the presence of psychiatric symptoms and disorder. However, agreement between physicians has been shown to be low (Rutter,Tuma & Lann 1988) and the usefulness of physician - assessed disorder as a gold standard is controversial. Physicians can be trained, using structured clinical interviews to produce acceptable levels of agreement, but the levels achieved may not translate into everyday practice. Even under conditions of acceptable agreement, the validity of the diagnosis can still be questioned. As a result, multiple - method, multiple informant approaches are recommended (Spitzer, 1983; Rutter, Tuma & Lan, 1988; Brandenburg, Friedman & Silver, 1990).

Structured interviews are designed to elicit information about psychiatric symptoms. They can be grouped into: i) highly - structured approaches wherein a trained interviewer administers a scripted interview without deviation and codes responses according to categories provided; and ii) semi - structured approaches that utilize flexible guidelines and require clinical expertise to administer. Structured interviews include the Diagnostic Interview Schedule for Children and Adolescents (DISC), the Schedule for Affective Disorders and

Schizophrenia for Children (K - SADS), the Diagnostic Interview for Children and Adolescents (DICA) and the Child Assessment Schedule (CAS) (Edelbrock C & A Costello, 1988). These interview schedules have demonstrated acceptable reliability and validity in children over 10 years of age. However, in children under 10, reliability is low (Edelbrock Costello, Dulkan, Kalas & Conover, 1985; Schwab - Stone, Fallon, Briggs & Crowther, 1994). Clinical judgment is needed to derive diagnoses for the K - SADS and the CAS. Computerized diagnostic algorithms are used to derive diagnoses from the DISC. Methods to map DICA responses to DSM diagnoses are available.

Psychiatric symptom checklists include the Child Behaviour Checklist (Achenbach & Edelbrock, 1983), the Revised Behaviour Problem Checklist (Quay & Peterson, 1983; 1984) and the Ontario Child Health Study Scales (Boyle et al., 1987; Boyle et al., 1993). The checklist approach is relatively inexpensive, simple to administer, allows information to be collected independently from multiple informants, including the child and has been used successfully in a number of epidemiological studies (McConaughy, Stanger & Achenbach, 1992; Boyle et al. 1993). Extensive information is available documenting the reliability and validity of the checklist approach (Barkley, 1988). The Child Behaviour Checklist and the Revised Behaviour Problem Checklist were derived empirically and are not directly linked to DSM diagnostic criteria sets. The OCHS scales were designed to operationalize DSM - III (OCHS scales) and - IIIR (OCHS scales revised; OCHS - R) criteria sets for disorder and will be used in this study.

Naturalistic observation consists of direct observations of the child to document the occurrence of pre-specified behaviours (Reid, Patterson, Baldwin & Dishion, 1988). A highly trained observer uses a detailed observation schedule that identifies the specific behaviours, time period and setting of observation. The main advantage of this approach is the objectivity and standardization of

measurement. However, the disadvantage is that some important behaviours either cannot be observed or occur with such a low frequency that direct observation is infeasible. In addition, direct observation is expensive.

3.8.1.3 Comorbidity

Substantial co - morbidity exists between disorders and the rates observed are above that expected by chance (Caron & Rutter, 1991). For example, the overlap in children in the Ontario Child Health Survey (defined as the presence of more than one disorder) was 68.2 percent (Offord, Boyle & Racine, 1989b). Similar rates of overlap (55 percent) were found in another large population - based study, the Dunedin Multidisciplinary Study of Child Development (Anderson, Williams, McGee & Silva, 1987).

The observed co-morbidity raises a number of issues, for example, the extent to which comorbidity is a measurement artifact, the distinctiveness of the individual diagnostic categories and the significance of common comorbidities with respect to underlying mechanisms, prognosis and response to treatment (Caron & Rutter, 1991). The distinctiveness of the broad-band categories of externalizing and internalizing disorders has been demonstrated with respect to some aspects of natural history, prognosis and family characterstics (Hinshaw, 1987). However, children with externalizing disorders may also have internalizing disorders, particularly in the case of severe disorder. Much less evidence exists to support the distinctiveness of the narrow - band disorders. For example, within the externalizing disorders, substantial co - morbidity has been observed between conduct disorder and attention - deficit hyperactivity disorder varying from 30 to 50 percent. However, external correlates of the two disorders suggest some distinctiveness (Hinshaw, 1987; Szatmari, Boyle & Offord, 1989). Conduct disorder appears to arise more often in children where antisocial parents, family discord and socio-economic disadvantage are present and

children with conduct disorder have poor adult outcomes with respect to psychosocial adjustment. Children with attention - deficit hyperactivity disorder do not share these correlates and outcomes. Instead, the correlates relate more often to variables associated with developmental delay. Several authors have proposed that when conduct disorder and attention-deficit hyperactivity disorder occur together this represents a separate disorder with a worse prognosis than either conduct disorder alone or attention-deficit hyperactivity disorder alone (Hinshaw, 1987; Moffitt, 1993; Lynam, 1996). Consequently, studies that aim to investigate individual diagnostic categories with respect to etiology, outcome or response to treatment need to separate individuals with pure and comorbid disorder in the design and interpretation of the study.

Comorbidity between conduct disorder and depression has also been documented (Puig-Antich et al., 1989; Harrington et al., 1992), but very few studies are available to address questions regarding the relation between them (Caron & Rutter, 1991).

3.8.1.4 Influence of Informant

Informant refers to the source of information about behaviour, namely, the parent, teacher, child or peer. An extensive review of the literature has shown that agreement between informants regarding the presence of symptoms or disorder is low when behaviour is rated independently by informants (Achenbach, McConaughy & Howell, 1987). Agreement within informant is higher than between informants. However, as has been pointed out by these authors and others, the lack of agreement may reflect important influences on the assessment of behaviour, specifically: i) the response set of the informant; and ii) the effect of context on the occurrence of behaviour. That is, the differences observed may be explained by different viewpoints regarding what is deviant

(that is, thresholds) and/or the fact that deviant behaviour may be present in one context but not another.

3.8.1.5 Presence of Disorder

The presence of disorder is inferred using information provided by one or more informant. In the clinical context, diagnosis is usually arrived at by the physician who uses implicit rules (that is, clinical judgment) to combine information from multiple sources. In the research context, physician - assessed disorder is usually not feasible and a method to determine caseness is a fundamental part of the research process. One approach is to view disorder as informant - specific. By default, this has been the approach in many studies that used checklist approaches and only obtained information from one informant (usually at a single point in time). In this case, the only decision required is a cut - point for the presence of disorder in terms of the number of symptoms or symptom score. If persistence is also a criterion, then symptoms must be present on more than one occasion. Clearly, this approach does not take into account the general consensus that exists in the field, that multiple sources and methods of obtaining information should be used to determine the presence of disorder (Spitzer, 1983; Brandenburg, Friedman & Silver, 1990). However, in the research context, the usefulness of any approach must be judged in relation to the study objectives.

The alternate approach is to obtain information from multiple informants and to devise a method or set of rules to combine the available data and arrive at an estimate of caseness. Most investigators who use this strategy combine the available information about symptoms and impairment using three criteria: i) the presence of a symptom score above a pre-selected cut-point; ii) evidence that symptoms are present in more than one context, usually operationalized as reported by more than one informant; and iii) the persistence of the symptoms

over repeated assessments. However, how these three criteria are operationalized in practical terms varies from study to study and this variation may influence the comparability of studies using different symptom sets and rules for deciding caseness.

At the present time, relatively little is known about the optimal method for combining information to determine the presence of a symptom or 'caseness' and very few evaluations of alternate approaches are available in the literature (Brandenburg, Friedman & Silver, 1990; Offord et al., 1996a; Boyle et al., 1997; Chess, 1997). Two evaluative approaches have been used in the available studies. The first approach is concerned with replicating clinical diagnoses and therefore evaluates the accuracy of alternative methods compared to diagnoses made by physicians. The methods that have been reported include the development of simple and complex algorithms and the identification of optimal informants for certain types of symptoms. Simple algorithms appear to perform as well as more complex approaches when the comparator is clinical diagnosis (Loeber, Green, Lahey, & Stouthamer - Loeber, 1990; Bird, Gould & Staghezza, 1992; Piacentini, Cohen & Cohen, 1992).

The second approach has a different objective and aims to evaluate the effects of different methods of combining information on the correlates of disorder (Offord, Boyle & Racine, 1989b; Offord et al., 1996; Boyle et al, submitted - c). These studies show that the method used can have important effects on findings. For example, compared with an informant - specific definition of disorder, when presence of disorder is defined as parent <u>or</u> teacher reported disorder, the distinctive patterns of the associated features of informant-specific disorder are masked (Offord et al., 1996a).

Latent variable methods are beginning to be explored as a method that allows multiple sources of information to be combined through the creation of a

latent construct (Fergusson & Horwood, 1995; Boyle et al., submitted - c). This approach takes advantage of developments in statistical modelling procedures that increase the precision and efficiency of analysis and allow multiple variables to be considered within a comprehensive model of the assumed relationships between behaviour and associated correlates and risk factors. At present, the application and interpretation of these approaches requires expert knowledge. Accordingly, increased awareness and understanding of these methods and demonstrations of their added value compared to existing methods are called for.

A final point concerning the presence of disorder is the selection of thresholds. That is, the number of symptoms that must be present or the scale score that must be exceeded in order for disorder to be deemed present. The selection of thresholds at the present time does not have a strong empirical base (Offord & Fleming, 1996b). The threshold selected will determine the prevalence of disorder: a low threshold will result in a high prevalence and a high threshold will result in a low prevalence. Moreover, the study of risk factors and correlates of disorder will also be influenced by the choice of a strict or conservative threshold.

3.8.2 Measures Available in Host Study

The Tri-Ministry study provides parent and teacher reports of externalizing disorder symptoms and impairment as described below.

3.8.2.1 Psychiatric Symptom Scales

The Ontario Child Health Study Scales - Revised (OCHS - R) are psychiatric symptom checklist scales designed to operationalize DSM - III and IIIR criteria for the externalizing and internalizing disorders. The scales are completed by the parent, teacher and child (if 11 years of age or older) and have undergone extensive evaluation to establish their reliability and validity (Boyle et al., 1987; Boyle et al., 1992; Boyle et al., 1993) including a comparison with

structured interview methods which showed that the OCHS scales performed adequately when compared to the DICA, administered by a trained interviewer (Boyle et al., 1996a, 1996b).

Externalizing scales based on DSM - IIIR diagnostic criteria are available for conduct disorder (CD), attention-deficit disorder (ADHD) and oppositional defiant disorder (ODD). However, clinical thresholds (that is, scale cut-points) for the presence of DSM - IIIR disorder are not available. Scales based on DSM - III diagnostic criteria are available for conduct disorder, attention deficit disorder and emotional disorder (Boyle et al., 1987). Clinical thresholds are available for these three scales. They were derived by selecting the symptom scale score that maximized agreement with the diagnostic classification assigned by a psychiatrist.

The present study will use the DSM - IIIR version of the scales because this version is more recent and includes the ODD scale. The lack of clinical thresholds is not a disadvantage because in the age group studied clinical thresholds for disorder would yield too low a prevalence rate to be useful. Table 3.14 summarizes the characteristics of the OCHS - R scales for the (DSM - IIIR) externalizing disorders; parent and teacher reports are available in the age group studied. Scale items are shown in Tables 3.15, 3.16, 3.17. All ODD and ADHD items are completed by both parents and teachers. For the CD scale, 3 items are omitted for the teacher version on the assumption that the teacher does not have sufficient opportunity to observe their occurrence (steals outside the home; runs away from home; has broken into someone else's house/building).

3.8.2.2 Impairment Scales

Impairment is defined as decrements in social, academic or occupational functioning. However, it is extremely difficult to attribute impairment to the presence of symptoms. In most instances an assessment of the relation between

symptoms and impairment will require an expert judgment to be made. In the age group targeted in this study, impairment can be defined in three areas: i) problems getting along with others; ii) poor school performance; and/or iii) need for and use of clinical and social services.

Table 3.18 summarizes the measures of impairment available in the Tri-Ministry data set. Teacher informant data is available for problems in school but not for problems getting along and utilization of services.

3.8.3 Measures Selection for Conduct Problems: Methodologic Issues

Six methodologic criteria can be considered in selecting variables from those described above to create the study outcome variable: content of variable; context of assessment; perspective or informant; scale measurement characteristics; symptom scale threshold for presence of disorder; and pure or comorbid disorder. Each issue is discussed in turn below.

3.8.3.1 Content

The essential features are: i) aggressive, non-compliant behaviour with impairment; and ii) face and content validity with respect to children in the age range when outcomes will be assessed, that is six - to eight - year - old children.

3.8.3.1.1 Conduct Problem Symptoms

The content of both the oppositional defiant disorder and conduct disorder symptom scales is consistent with aggressive, non-compliant behaviour. However, the conduct disorder scale items reflect extreme forms of aggression and non-compliance with norms. Several of the items have only marginal face-validity with respect to their developmental appropriateness in age group included in this study. As discussed above, oppositional defiant disorder is considered to be an early form of conduct disorder (Earls, 1994). The scale items reflect disruptive, externalizing behaviour and have face validity with respect to their applicability in the study age group.

Table 3.14
Ontario Child Health Study Scales - Revised:
Scale Characteristics for Oppositional Defiant Disorder, Conduct Disorder and Attention - deficit Hyperactivity Disorder

Scale	Method of Assessment	Informant* P	Informant* T	Scale Items(#) P	Scale Items(#) T	Response Options	Scale Score Min - Max P	Scale Score Min - Max T
Oppositional Defiant Disorder	Self -complete Behaviour Symptom Checklist	√	√	9	9	0 = Never or not true 1 = Sometimes or somewhat true 2 = Often or very true	0-18	0-18
Attention-deficit Hyperactivity Disorder				14	14		0-28	0-28
Conduct Disorder				12	9		0-24	0-18

*P = Parent informant; T = Teacher informant

Table 3.15
Ontario Child Health Study Scales Revised:
Oppositional Defiant Disorder Scale Items

		Parent	Teacher
1.	Temper tantrums or hot temper	√	√
2.	Argues a lot with adults	√	√
3.	Defiant, talks back to adults	√	√
4.	Does things that annoy others	√	√
5.	Blames others for own mistakes	√	√
6.	Easily annoyed by others	√	√
7.	Angry and resentful	√	√
8.	Gets back at people	√	√
9.	Swearing or obscene language	√	√
		9	9

Table 3.16
Ontario Child Health Study Scales Revised:
Conduct Disorder Scale Items

		Parent	Teacher
1.	[Steals] at home	√	[√]
2.	Steals outside the home	√	
3.	Runs away from home	√	
4.	Lying or cheating	√	√
5.	Sets fire	√	√
6.	Truancy, skips school	√	√
7.	Has broken into someone else's house/building	√	
8.	Vandalism	√	√
9.	Cruel to animals	√	√
10.	Uses weapons when fighting	√	√
11.	Physically attacks people	√	√
12.	Cruelty, bullying or meanness to others	√	√
		12	9

Table 3.17
Ontario Child Health Study Scales Revised:
Attention-deficit Hyperactivity Disorder Scale Items

	Parent	Teacher
1. Fidgets	√	√
2. Can't stay seated when required to do so	√	√
3. Distractible, has trouble sticking to any activity	√	√
4. Has difficulty waiting turn in games or groups	√	√
5. Interrupts, blurts out answers to questions too soon	√	√
6. Has difficulty following directions or instructions	√	√
7. Can't concentrate, can't pay attention for long	√	√
8. Jumps from one activity to another	√	√
9. Has difficulty playing quietly	√	√
10. Talks excessively	√	√
11. Interrupts or butts in on others	√	√
12. Doesn't seem to listen	√	√
13. Loses things	√	√
14. Does dangerous things without thinking	√	√
	14	14

3.8.3.1.2 Impairment

Teacher reports of impairment are available for poor school performance. Two options are available (Table 3.19): i) teacher reports of reading, arithmetic performance and overall academic performance; or ii) teacher reports about how well the child is doing at school, for which parent reports are also available. The first option will be used because this question focuses explicitly on academic performance and asks the teacher to compare the student's actual performance with expected performance for the grade level of the child. The second option is not specific to academic functioning. Also, the respondent is not given any explicit guide regarding the comparator to be used in responding and this may result in heterogeniety among children assigned to the same response level.

3.8.3.2 Context of Assessment

Context is an important determinant of behaviour. Behaviours that occur regularly in one context may occur infrequently or not at all in another (Achenbach, McConaughy & Howell, 1987). The present study is concerned with conduct problems that occur in the school and therefore assessment needs to take place in this context.

3.8.3.3 Perspective or Informant

Both parent and teacher reports are available in the Tri-Ministry study. Teacher reports of conduct problems will be used on the assumption that they are based almost exclusively on child behaviour in the school setting. The teacher is asked to complete the externalizing symptom scales according to the following instructions:

> Teacher: Below is a list of statements that describe some of the feelings and behaviour of children. For each statement, please check the box that best describes this child now or within the past month.
>
> (The items that make up the scale are then presented in a list.)

3.8.3.4 Variation in Scale Scores

Table 3.20 shows the frequency distribution of scale scores for ODD and CD based on teacher reports. As summarized in Table 3.21, approximately 55 percent of children have a scale score of zero for CD at each assessment, while only about 37 percent of children have a scale score of zero for ODD at each assessment based on teacher reports. The percent of children who receive a scale score of greater than or equal to five ranges from 8.5 to 10.0 percent for CD compared to 26.3 to 30.4 percent for ODD. Hence, the ODD scale provides greater variation in individual scale scores.

3.8.4 Outcome Definition

Based on the foregoing, clinically important conduct problems will be defined as follows: ODD symptoms present (teacher informant) plus poor school performance (teacher informant). The effect on the results of using CD symptoms present (teacher informant) plus poor school performance (teacher informant) will be evaluated by re - running the analyses with this outcome. The scale cut - points for designating ODD or CD symptoms present and poor school performance are as follows.

3.8.4.1 Scale Thresholds

The presence of clinically important levels of conduct problem symptoms will be defined as an ODD scale score of greater than or equal to the 80th percentile of the ODD symptom scale distribution at the 30 month followup assessment. This variable will be referred to as ODD symptoms present. For the alternate analysis using CD symptoms, the definition will be the same. That is, the variable 'CD symptoms present' will be defined as a CD symptom scale score of greater than or equal to the 80th percentile at the 30 month followup assessment.

Table 3.18
Tri-Ministry Study: Impairment Scales

Scale	Parent Report	Teacher Report
1. Problems getting along with others (friends/classmates, parents, teachers).	√	NA†
2. Poor School Performance		
Question 1*	NA	√
Question 2**	√	√
3. Clinical and Social Services		
Utilization	√	NA
Need	NA	√

* See Table 3.21 for question
** See Table 3.22 for question
† NA = not available

Table 3.19
Poor School Performance

Option 1: Teacher self-complete questionnaire.

How would you describe this student's current school performance in the following categories?

	(1) Far Below Grade	(2) Some-what Below Grade	(3) At Grade Level	(4) Some-what Above Grade	(5) Far Above Grade	(6) Don't Know
A. Reading or Reading Readiness	_	_	_	_	_	_
B. Arithmetic or Math	_	_	_	_	_	_
C. Overall	_	_	_	_	_	_

Option 2: Teacher, self-report; parent, interviewer administered.

Just tell me the number beside the phrase which best describes your child. How well has _____ done at school since January? Would you say.....

1. Very well, excellent student
2. Quite well, good student
3. Pretty well, average student
4. Not too well, below average student
5. Not that well at all, poor student

Table 3.20
OCHS - R Scale Score Frequency Distribution
(Teacher Informant)

Oppositional Defiant Disorder

Scale Score	Assessment (Month) (n, %) 0	6	30
0	263, 37.0	269, 36.8	266, 37.1
1 - 2	162, 22.8	166, 22.7	159, 22.2
3 - 4	86, 12.1	74, 10.1	85, 11.9
5 - 6	65, 9.2	65, 8.9	62, 8.6
7 - 8	44, 6.2	67, 9.2	52, 7.3
9 - 10	32, 4.5	37, 5.1	32, 4.5
11 - 12	33, 4.6	21, 2.9	21, 2.9
13 - 14	13, 1.8	12, 1.6	19, 2.6
15 - 16	11, 1.5	11, 1.5	15, 2.1
17 - 18	1, 0.1	8, 1.1	6, 0.8

Conduct Disorder

Scale Score	Assessment (Month) (n, %) 0	6	30
0	390, 55.2	401, 55.2	400, 56.1
1 - 2	189, 26.7	167, 23.0	185, 25.9
3 - 4	68, 9.6	86, 11.8	70, 9.8
5 - 6	35, 5.0	42, 5.8	35, 4.9
7 - 8	20, 2.8	19, 2.6	16, 2.2
9 - 10	5, 0.7	9, 1.2	5, 0.7
11 - 12	0	2, 0.3	1, 0.1
13 - 14	0	0	1, 0.1
15 - 16	0	0	0, 0.0
17 - 18	0	0	0, 0.0

Table 3.21
Summary of Scale Score Distribution:
Oppositional Defiant Disorder and Conduct Disorder

Scale Score	Assessment					
	Baseline		6 Months		30 Months	
	ODD	CD	ODD	CD	ODD	CD
	(%)		(%)		(%)	
0	37.0	55.2	36.8	55.2	37.1	57.4
1 - 4	34.9	36.3	32.8	34.8	36.6	32.9
≥ 5	28.1	8.5	30.4	10.0	26.3	9.7

The selection of a cut point for the symptoms scales is arbitrary and is intended to provide a prevalence rate of conduct problems (symptoms plus impairment) of between 10 and 15 percent. As already noted, clinical thresholds for the presence of DSM - IIIR disorder are not available for the OCHS - R scales. However, because of the age group studied, even if clinical thresholds were available, the prevalence of disorder would be too low to be useful.

For poor school performance, the cut - point is selected to identify children who are performing below grade level. This corresponds to a scale score of less than or equal to 2 (see Table 3.19).

3.8.4.2 Pure and Comorbid Disorder

Study outcomes will be defined using comorbid disorder for two reasons. First, as will be presented in the results section, very few children have pure ODD or CD based on the teacher report. Second, the objective of intervention is to target children with aggressive, externalizing symptoms regardless of the presence of symptoms that are consistent with other disorders (for example ADHD or the internalizing disorders).

3.9 Study Predictors

Predictor variables from the following four groups will be evaluated. The specific variables and measures used are described below.

i) Externalizing disorder symptoms: oppositional defiant disorder scale score; attention - deficit hyperactivity disorder scale score; conduct disorder scale score;

ii) Other child characteristics: reading achievement standard score; gender;

iii) Parent and family functioning: level of maternal education, maternal depression symptoms, parenting practices score, social support score; and family functioning score.

iv) Socio-economic disadvantage: annual household income.

3.9.1 Externalizing Behaviour Symptoms

Eight externalizing behaviour variables will be evaluated as predictors of outcome using teacher reports of symptoms obtained at baseline and six months of followup. In the analysis using ODD symptoms, four of these are OCHS - R symptom scale scores for ODD (baseline and six month followup) and attention - deficit hyperactivity disorder (ADHD; baseline and six month followup). (The OCHS - R ODD and ADHD scales were described in section 3.8.2.1.)

Four additional categorical variables will be created from the ODD and ADHD symptom scores: ODD persistent; ADHD persistent; ODD pervasive and ADHD pervasive. The rationale for these variables is that the likelihood of future disorder may be higher in children who possess persistent or pervasive symptoms in kindergarten or grade one. Persistence variables are defined as a scale score greater than or equal to the 80th percentile of the symptom scale score distribution at baseline and six months of followup (ODD persistent; ADHD persistent). Pervasiveness variables are defined as a scale score of greater than or equal to the 80th percentile of the symptom scale score distribution at assessment one or two, parent and teacher reports (ODD pervasive; ADHD pervasive).

For the alternate analysis using CD symptoms, the same approach will be taken substituting CD symptoms for ODD symptoms. That is, eight externalizing behaviour variables will be evaluated as follows: CD symptom scale score (baseline and six months; see section 3.8.2.1 for scale description and items), ADHD symptom scale score (baseline and six months); CD persistent; ADHD persistent; CD pervasive; ADHD pervasive.

3.9.2 Other Child Characteristics

3.9.2.1 Reading Achievement

The reading standard score from the Wide Range Achievement Test (WRAT; Jastak & Wilkinson, 1984) will be used as a predictor because of the association of reading problems and academic underachievement with conduct problems (Hinshaw, 1992). The WRAT was developed in the 1930's to complement tests of general cognitive ability such as the Wechsler. Wide range refers to the fact that the test was designed to assess individuals from age 5 to 75. The reading score is based on letter and word recognition. Comprehension is not assessed. The scores reflect the child's ability relative to population norms.

The WRAT is widely used because it is simple to administer, relatively brief and few alternatives are available (Bracken, 1991). Scores rise with age and therefore, one of the recommended uses of the WRAT (by its developers) is the assessment of developmental skills and rates of change of competencies. However, it is important to note that the WRAT has been criticized by modern test developers and psychologists. The extent to which the WRAT measures what it proposes to measure has been challenged due to: i) the lack of demonstrated construct validity; ii) questions about the appropriateness of the scale content; and iii) the adequacy of the norms sample with respect to bias against blacks, hispanics and other minorities.

3.9.2.2 Gender

Gender will be used as predictor variable because the likelihood of conduct problems is higher in males than females (Zoccolillo, 1993).

3.9.3 Parent and Family Functioning

Five familial risk factors for conduct problems will be evaluated using parent report at the baseline assessment (Institute of Medicine, 1994): maternal depression symptoms, level of maternal education, parenting practices, social

support and family functioning. Table 3.22 summarizes the basic characteristics of the scales available in the Tri - Ministry study for each variable. The scale items or question(s) used are included as appendices as indicated below.

3.9.3.1 Maternal Education

Level of maternal education was based on parent - report in an interviewer administered questionnaire (Appendix 2: 1 = no schooling and 9 = completed university or teacher's college).

3.9.3.2 Maternal Depression

Maternal depression was assessed using the Centre for Epidemiologic Studies - Depression Scale (CES - D; Radloff, 1977; Appendix 3). The CES-D is a 20 item self - complete questionnaire with demonstrated reliability and validity. Scores range from 0 to 60. Scale cut-points have been evaluated in relation to clinical levels of depression (Barnes & Prosen, 1984). A score of 31 or higher is predictive of a clinical diagnosis of severe depression.

3.9.3.3 Parenting Practices

Parenting practices were assessed using a 17 item self - complete questionnaire with scores ranging from 17 to 68 (Patterson, 1982; Lochman, 1995; Appendix 4). The scale items concern child disciplinary practices, specifically rules and methods for dealing with rule-breaking and the use of harsh and ineffective control strategies. Evidence for reliability and validity is not currently available.

3.9.3.4 Social Support

Social support is measured using the total score for the Social Provisions Scale (Cutrona & Russell, 1987; Appendix 5). This scale is designed to assess the social provisions or functions provided by social relationships and is made up of 24 items divided into 6 subscales: reliable alliance, attachment, guidance, nurturance, social integration and reassurance of worth. The rationale for the

Table 3.22
Parent and Family Functioning Predictor Variables

Variable	Method of Assessment	Scale/Questionnaire	Informant	Response Options	Scale Items (# min and max score)
Maternal Education	Interviewer Administered Questionnaire	Tri-Ministry Study Baseline Questionnaire (Appendix 2)	Parent	- 9 levels of schooling from no schooling to completed university or teachers college	- 9; - 1 - 9 (high is good)
Maternal Depression	Self-complete Questionnaire	Centre for Epidemiologic Studies - Depression Scale (CES-D) (Appendix 3)	Parent	0 = Rarely or none of the time 1 = Some or little of the time 2 = Occasionally or a moderate amount of time 3 = Most or all of the time	- 20; - 0 - 60 (high is bad) - depression present = ≥31
Parenting Practices	Self-complete Questionnaire	FAST Track Parenting Practices Questionnaire (Appendix 4)	Parent	1 = never 2 = almost never 3 = sometimes 4 = often	- 17; - 17 - 68 (high is bad) - no cutpoint for poor parenting
Social Support	Self-complete Questionnaire	Social Provisions Scale (Appendix 5)	Parent	1 = strongly disagree 2 = disagree 3 = agree 4 = strongly agree	- 24; - 24 - 96; high is good - no cutpoint
Family Dysfunction	Self-complete Questionnaire	McMaster Family Assessment Device (Appendix 6)	Parent	1 = strongly disagree 2 = disagree 3 = agree 4 = strongly agree	- 12; - 12 - 48 (high is bad) - family dysfunction present = ≥27

subscales is that each one defines a specific function of a social relationship and each one contributes to an individual's overall sense of support or avoidance of loneliness. Accordingly, the scale is designed to be sensitive to the range of specific functions of a social relationship and to the fact that different relationships can perform different functions. The reliability and validity of the measure have been reported to be satisfactory (Cutrona & Russell, 1987).

3.9.3.5 Family Functioning

Family functioning was assessed using the General Functioning Sub-scale of the McMaster Family Assessment Device (Byles, Byrne, Boyle & Offord, 1988; Appendix 6). This self - complete scale consists of 12 items: six assess healthy family functioning and six describe unhealthy family functioning. Reliability and validity of the General Functioning sub - scale as a measure of global family functioning has been evaluated (Byles, Byrne, Boyle & Offord, 1988). Tests of internal consistency were satisfactory and the association between scale scores and other external variables was consistent with prior hypotheses. Parental deviance, alcohol abuse, emotional disorder of parent, marital disharmony, parental separation, spouse abuse and mental health of parents were associated with general functioning sub-scale scores but geographic location, physical health of parent or family size were not.

3.9.4 Socio-economic Disadvantage

Socio - economic disadvantage is a risk factor for conduct problems and antisocial behaviour and is assessed using parent report of annual household income at the baseline assessment (Appendix 7: 1 = <$10,000; 10 = > $80,000).

3.10 Analytic Methods

3.10.1 Data Summary and Descriptive Statistics

Means and proportions will be used to describe the outcome and predictor variables used in this study. Standard deviations and confidence intervals will

be calculated as called for. The Student's t test will be used to compare means and classic Chi - square will be used to compare proportions (Fleiss, 1981). Odds ratios are used to quantify the strength of association between two categorical variables. Pearson's correlation co - efficient is used to quantify the relation between two variables measured on a continuous scale.

3.10.2 Logistic Regression

Logistic regression will be used to create linear predictors of the logarithm of the odds of conduct problems using the predictor variables identified above (Fleiss, Williams & Dubro, 1986; Afifi & Clark, 1996). The outcome is binary (presence or absence of clinically important conduct problems) and the predictors (independent variables) are either discrete or continuous.

The assumption made in logistic regression is that the natural logarithm of the odds (ln[odds]) is linearly related to the independent variables. The logistic function is as follows and expresses the probability of the outcome:

$$P(\text{outcome}) = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 \ldots)}}$$

or

$$\ln(\text{odds}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_p X_p \quad \text{[linear predictor]}$$

Logistic regression models are fit to data using the method of maximum likelihood. The likelihood function is proportional to the probability of obtaining the observed set of data and depends on unknown parameters which, in this case, represent the regression coefficients in the linear predictor. The co - efficients which maximize the likelihood function are the maximum likelihood estimates. The significance of a linear predictor can be assessed using the likelihood - ratio statistic, which has a distribution that is approximately chi - squared.

Fitting the logistic regression model provides estimates of the α and β coefficients for the linear predictor ($\alpha + \beta_1 X_1 + \beta_2 X_2 \ldots$). The X_i correspond to the independent variables (that is, individual predictor variables). The intercept is represented by α (ln[odds]) of the outcome when all the other X_i's equal 0, β represents the change in the magnitude of ln[odds] of the outcome associated with a one unit change in X_i when the values of the other X_i variables remain the same. Exp β is the odds ratio associated with a one unit change in X_i when the value of all the other variables remains the same.

In the present study, linear predictors will be created using a pre-determined, hierarchical, forward procedure. SPSS (version 7.5) is the statistical software package used (Norusis & SPSS Inc, 1997). Predictor variables will be entered as described below in sections 3.10.6.1 to 3.10.6.3. All individual predictor variables that achieve a statistically significant likelihood - ratio (LR) chi - square, given those already in the model ($p \leq 0.05$, variable in versus variable out; SPSS calls this the improvement -2LogL) will remain in the model. Any variable that becomes non - significant following the addition of another variable will be dropped from the linear predictor. The statistical significance of each linear predictor created is also evaluated using the likelihood - ratio statistic ($p \leq 0.05$, intercept only versus intercept plus p predictor variables; SPSS calls this the model - 2LogL). For each unique linear predictor created, the following results will be presented and discussed:

a) - 2 Log likelihood (- 2LogL)

- 2LogL is calculated to assess the fit of the logistic regression model. - 2LogL quantifies how likely the sample results are given the parameter estimates from the logistic regression model. A model with a perfect fit has a likelihood of 1 and therefore - 2LogL is equal to 0.

In SPSS, values of - 2LogL are obtained and used to evaluate model fit as follows:

• For the model containing α (intercept) only : - 2LogL is calculated for the model containing the α (intercept) only and used as a base for comparing alternative models composed of p predictor variables (covariates).

• For the model containing both α and $\beta_1, \beta_2, \beta_3 \ldots \beta_p$ (intercept and covariates): This value of - 2LogL is the - 2Log likelihood of the model containing both the intercept and the covariates. It has a chi - square distribution with N - (p + 1) degrees of freedom (N = sample size; p + 1 = the number of parameters). The null hypothesis is that the model fits perfectly (likelihood equals 1).

• Model - 2LogL: To test the hypothesis that $\beta_1 = \beta_2 = \beta_p = 0$ the likelihood - ratio statistic is computed as the difference between - 2Log L for the intercept/constant only model and - 2LogL for the model containing the intercept and the set of p covariates being investigated. It has a chi - square distribution; the degrees of freedom, p, equal the difference between the number of parameters for the intercept only model (1) and the number of parameters in the complete model (p + 1). The null hypothesis is that the coefficients for all the covariates equal zero. SPSS calls this the model - 2LogL; it is equivalent to the model likelihood - ratio (LR) chi - square. Each linear predictor is evaluated using this statistic as stated above.

• Improvement - 2LogL: To test the hypothesis that $\beta_{p+1} = 0$ the likelihood - ratio statistic is computed as the difference between - 2Log L for the model containing p covariates and - 2LogL for the model containing p + 1 covariates (the change in - 2LogL that occurs by

adding the p + 1 covariate). It has a chi - square distribution; the degrees of freedom (1) are the difference between the degrees of freedom for the model with p covariates and the model with p + 1 covariates. The null hypothesis is that the β coefficient for the p + 1 covariate (added last) is zero given those already in the model. SPSS calls this the improvement - 2LogL; it is equivalent to the improvement likelihood - ratio (LR) chi - square. Each additional predictor variable included in a linear predictor will be evaluated using this statistic, as stated above.

b) R^2

The quantity R^2 will be presented for each unique model. This will be the Nagelkerke R^2 (Nagelkerke, 1991) and is intended to be used in a similar fashion to R^2 in multiple regression. That is, this value is an estimate of the proportion of variance in the outcome explained by the variables in the logistic regression model.

In multiple regression, R^2 is defined as follows:

$$\frac{\text{Variance explained by the model}}{\text{Variance explained by the model} + \text{Variance not explained by the model}}$$

The smaller the value of the error term (variance not explained), the higher the value of R^2. In logistic regression, variation in outcome and R^2 must be interpreted with respect to a binary outcome: "It has the interpretation as the proportion of explained 'variation', or rather, 1 - R^2 has the interpretation of the proportion of unexplained 'variation'. Variation should be construed very generally as any measure of the extent to which a distribution is not degenerate." (Nagelkerke, 1991).

c) Predicted Probabilities

Each unique linear model created will be used to generate the predicted probability of outcome for each individual. These values are then used to generate the sensitivities and specificities needed to create the receiver operating characteristic (ROC) curves described in the next section.

3.10.3 Receiver Operating Characteristic (ROC) Curves

Receiver operating curves were originally developed in the context of signal detection research in psychophysics as a method to separate 'signal' from 'noise'. Over the past two decades they have been applied increasingly in the evaluation of diagnostic and screening tests in health care (Weinstein et al., 1980; Murphy et al., 1987; Fombonne, 1991; Kraemer, 1992). An ROC curve plots the sensitivity of the predictor on the y axis (proportion of individuals who will develop the outcome who are identified by the predictor) against 1 minus specificity (1 minus the proportion of individuals without the outcome who will be correctly identified as not having it) for all possible values of a test result. Hence, this technique provides a method for examining the performance of a diagnostic or screening instrument across the full range of test scores. Figure 3.4 gives an example. The diagonal line (Curve A - line of no information) represents prediction equal to chance. Predictors that generate an ROC curve that falls above this line (indicating that prediction is greater than chance) can be compared using the area under the curve as shown. Curve C, the predictor with the largest area under the curve has a higher sensitivity for a given value of 1 minus specificity than does Curve B.

In this study the predicted probabilities of outcome generated with a linear predictor will be used to generate an ROC curve. This is achieved by comparing the predicted probabilities (which range from 0 to 1) with the known outcome (1/present or 0/absent) for each individual. Sensitivity, specificity and

accuracy are then calculated for each value of the predicted probabilities, or for an appropriate subset when a large number of values are available.

3.10.4 Optimal Cut-point

The choice of the optimal cut - point will depend upon the objectives of the investigator. Figure 3.5 depicts the decision analysis process that underlies the construction and evaluation of ROC curves. As shown, a test result, whether positive or negative has two possible outcomes: correct and incorrect classification. Very few tests are error free. The evaluative task is to select the test score (or predicted probability) that optimizes accuracy and minimizes the consequences of false positive and false negative classification errors. Weinstein (1980) has proposed a method for determining the optimal cut - point as shown in the following equation.

$$\frac{P(Xopt/D)}{P(Xopt/D)} = \frac{P(D)}{P(D)} \times \frac{CTN - CFP}{CTP - CFN}$$

Xopt = Optimal value of predictor for defining test positivity
P (D) = Probability of Disease
P (D) = Probability of No Disease
CTN = Cost of a True Negative
CFP = Cost of a False Positive
CTP = Cost of a True Positive
CFN = Cost of a False Negative

When the consequences of false positives and false negatives are equal, the optimal cut - point corresponds to the ratio of the probability of disorder being absent to the probability of disorder being present. This value provides the score that will yield the greatest likelihood of disorder, given a positive test result. When the consequences of false positive and false negative errors are not equal, then this ratio is adjusted by the utility associated with the consequences of each outcome (CTP, CFP, CFN and CTN) and the optimal cut - point is determined accordingly.

For the purposes of this study however, a different approach to the selection of the optimal cut - point will be taken. The overall goal is to determine whether a given predictor can achieve a sensitivity of at least 50 percent and a positive predictive value of at least 50 percent in populations with an expected prevalence of disorder of 15 percent. This translates into a specificity of 91 percent or more. That is, for a population prevalence of 15 percent and a sensitivity of 50 percent (at least half of the children in need are detected by the predictor), 91 percent is the minimum value of specificity that will yield a positive predictive value of 50 percent or more (at least half of the children identified as high risk are correctly classified).

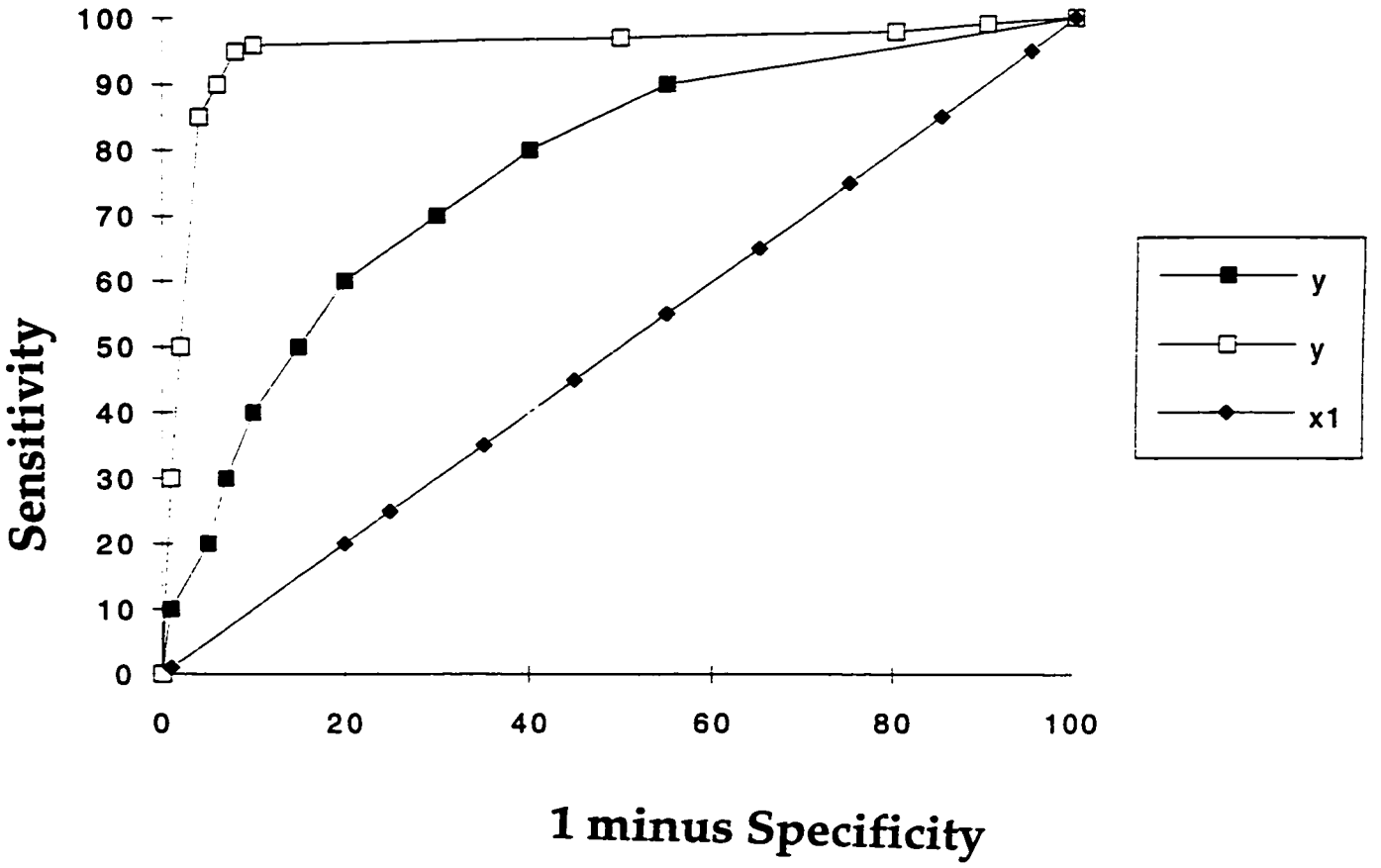
3.10.5 Increase in Accuracy Relative to Chance

The accuracy of prediction achieved with a given linear predictor and cut-point can be evaluated against the level of accuracy that could be obtained by selecting 15 percent of children at random. Table 3.23 shows the predictive accuracy the would be obtained under these conditions: sensitivity is 15 percent, specificity is 85 percent and accuracy is 74.5 percent.

3.10.6 Creation of Linear Predictors

The 16 predictor variables presented above will be used to create predictors of conduct problems. It is not feasible or necessary to evaluate linear predictors containing all possible combinations of the 16 predictor variables. Therefore, models will be evaluated containing: i) symptoms only (up to eight variables in total); ii) symptoms plus a single risk factor (up to nine variables in total); and iii) all variables (up to 16 variables in total). The predetermined, stepwise procedure described below will be used to derive one variable, two - variable and so on linear predictors. The one variable, two variable and so on approach allows the gain in predictive accuracy achieved by adding another

Figure 3.4
Receiver Operating Characteristic Curve: Example*



*x1 = Curve A
y (closed box) = Curve B
y (open box) = Curve C

Figure 3.5
Decision Analysis Tree

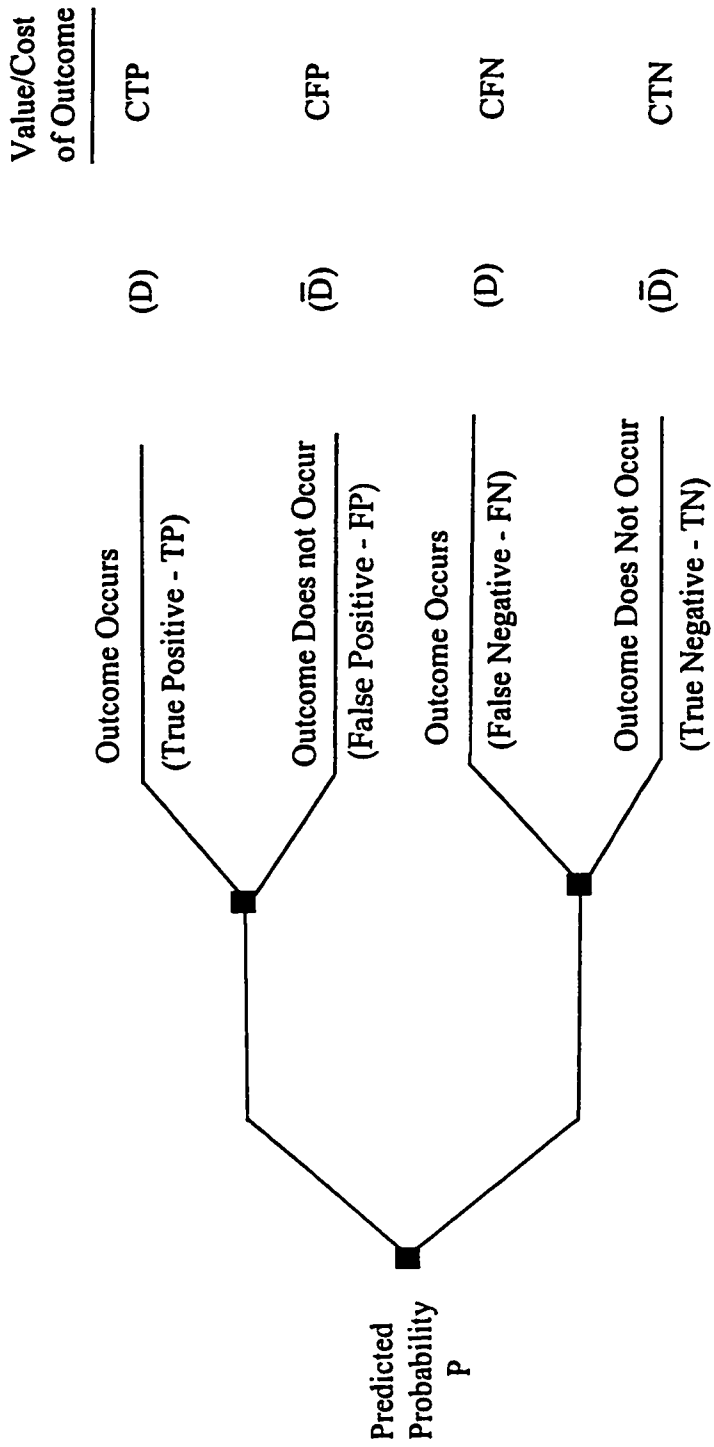


Table 3.23
Predictive Accuracy with Random Selection

		Outcome		
		Present	Absent	
Predictor	Present	22.5 (a)	127.5 (b)	150
	Absent	127.5 (c)	722.5 (d)	850
		150	850	1000

Sensitivity = a / a + c = 15 %
Specificity = d / b + d = 85 %
Accuracy = a + d / a + b + c + d = 74.5 %
Prevalence = a + c / a + b + c + d = 15 %

variable to the predictive index to be evaluated in relation to the effort required to collect the necessary data. The contribution of individual variables and model fit will be evaluated as already presented in section 3.10.2.

As stated in the methods section, the analysis will be conducted first using ODD symptoms to define the presence of conduct problems. Then, the analysis will be repeated using CD symptoms. The alternate outcome definitions are labeled as follows in the remainder of this chapter:

Outcome 1 (Conduct problems defined using ODD symptoms):

= ODD symptoms present (teacher) and poor school performance.

Outcome 2 (Conduct problems defined using CD symptoms):

= CD Present (teacher) and poor school performance.

3.10.6.1 Externalizing Symptoms Alone

Outcome 1: Conduct Problems (Oppositional Defiant Disorder Symptoms)

The eight externalizing symptom variables will be entered in the following order: 1. Symptom scale scores: ODD Score, baseline; ODD Score, 6 months; ADHD Score, baseline; ADHD Score, 6 months; 2. Persistence variables: ODD persistent; ADHD persistent; and 3. Pervasiveness variables: ODD pervasive; ADHD pervasive. Gender will then be added because of the ease of obtaining this variable at the time that symptom scales are completed for each child. Finally, two interaction terms will be tested: gender and ODD scale score and then gender and ADHD scale score.

Outcome 2: Conduct Problems (Conduct Disorder Symptoms)

The eight externalizing symptom variables will be entered in the following order: 1. Symptom scale scores: CD Score, baseline; CD Score, 6 months; ADHD Score, baseline; ADHD Score, 6 months; 2. Persistence variables: CD persistent; ADHD persistent; and 3. Pervasiveness variables: CD pervasive; ADHD pervasive. Gender will then be added because of the ease of obtaining this

variable at the time that symptom scales are completed for each child. Finally, two interaction terms will be tested: gender and CD scale score and then gender and ADHD scale score.

3.10.6.2 One Risk Factor plus Externalizing Behaviour Symptoms

Outcome 1: Conduct Problems (Oppositional Defiant Disorder Symptoms)

Each of the following risk factors -- reading achievement score, income level, maternal education level, maternal depression symptom score, parenting practices score, social support score and the family functioning score were evaluated in combination with the ODD and ADHD symptom variables and gender (for example, reading achievement standard score plus the eight ODD and ADHD variables and gender). The risk factor was entered first followed by the symptom variables and gender in the order stated above in section 3.10.6.2 for the symptoms alone model.

Outcome 2: Conduct Problems (Conduct Disorder Symptoms)

Each of the following risk factors --reading achievement score, income level, maternal education level, maternal depression symptom score, parenting practices score, social support score and the family functioning score were evaluated in combination with the CD and ADHD symptom variables and gender (for example, reading achievement standard score plus the eight symptom variables and gender). The risk factor was entered first followed by the symptom variables and gender in the order stated above in section 3.10.6.2 for the symptoms alone model.

3.10.6.3 All Variables Model

Outcome 1: Conduct Problems (Oppositional Defiant Disorder Symptoms)

The eight symptom variables will be entered in the order stated above in section 3.10.6.2 for the ODD symptoms only model (including gender) and then the other seven risk factor variables will be entered. The order for entering the

risk factor variables will be based on the ease of obtaining the necessary data (reading achievement score, maternal education, maternal depression symptoms, parenting practices score, social support score and family functioning score).

Outcome 2: Conduct Problems (Conduct Disorder Symptoms)

The eight symptom variables will be entered in the order stated above in section 3.10.6.2 for the CD symptoms only model (including gender) and then the other seven risk factor variables will be entered. The order for entering the risk factor variables will be based on the ease of obtaining the necessary data (reading achievement score, maternal education, maternal depression symptoms, parenting practices score, social support score and family functioning score).

3.10.6.4 Optimal Predictor: Methodologic and Practical Criteria

The following methodologic and practical criteria will be used to evaluate each of the linear predictors created:

i) the methods used to obtain the predictors are available now and are feasible and affordable in general populations of kindergarten and grade 1 children;

ii) the methods are acceptable to parents and teachers of kindergarten and grade one children;

iii) the contribution of each predictor variable is statistically significant based on the likelihood - ratio improvement chi - square test and the linear predictor is statistically significant based on the likelihood - ratio model chi - square;

iv) the area under the ROC curve is greater than 0.5 (above chance);

v) for those linear predictors that achieve an area under the curve of greater than or equal to 0.5, sensitivity is at least 50 percent and specificity is at the level needed to achieve a positive predictive value of at least 50 percent in populations with a prevalence of outcome of 15 percent, that is, 91 percent.

vi) for the linear predictor(s) with the greatest area under the curve, the extra effort (time and cost) required to obtain the predictors required is worth the gain in predictive accuracy.

3.11 Sample Characteristics and Completeness

Tables 3.24 and 3.25 show the characteristics of the study sample for all eligible children at enrolment (n = 1203), all sample one respondents (n = 746) and all sample one non-respondents (n = 457). As can be seen, there is a trend for non - respondents (families who did not participate at all three time points) to be disadvantaged compared to respondents (families who did participate at all three time points) on some baseline characteristics, sugggesting that sample loss was not random. However, the magnitude of the differences are small. Statistical significance ($p < 0.05$) was achieved for the ADHD symptom scale (proportion of symptom scale scores > 0) and low maternal education.

3.12 Study Variables: Descriptive Statistics

This section provides background data summaries and descriptive statistics for the following: i) study outcome; ii) relation between predictor variables and outcome; and iii) correlations between predictor variables.

3.12.1 Study Outcome

As described above, the study outcome variable is derived by creating categorical variables from continuously scaled variables for symptoms (ODD or CD) and impairment. The methods used and the resulting prevalence of outcome for outcome 1 (conduct problems defined using ODD symptoms) and outcome 2 (conduct problems defined using CD symptoms) are presented below.

3.12.1.1 Symptom Scale Cutpoints

The presence of ODD (or CD) symptoms is defined as the scale score that corresponds to greater than or equal to the 80th percentile. This rule is applied in each grade cohort at the 30 month assessment to derive the study outcome

Table 3.24
Sample 1
Baseline Child Characteristics†

Characteristics at Enrollment	Baseline Sample (n = 1203)	Respondents (n = 746)	Non-Respondents (n = 457)	
Male/Female (%)	53.9/46.1	53.6/46.4	54.5/45.5	
High - risk, N (%)	759 (63.1)	462 (61.9)	297 (65.0)	
Low - risk, N (%)	444 (36.9)	284 (38.1)	160 (35.0)	
		m (SD)		
Age (months)	67.9 (10.6)	67.7 (10.5)	68.3 (10.8)	
Reading Standard Score	88.0 (15.0)	88.5 (15.4)	87.1 (14.2)	
Arithmetic Standard Score	89.3 (19.6)	90.5 (19.7)	86.8 (19.1)	
		N (%)		
Symptom Scale Score > 0				
Oppositional Defiant Disorder	653 (64.3)	447 (62.9)	206 (67.5)	
Attention - deficit Hyperactivity Disorder	829 (81.6)	569 (80.0)	260 (85.3)	*
Conduct Disorder	465 (46.0)	317 (44.8)	148 (48.6)	

† Statistically significant difference between respondents and non - respondents:
*p <0.05; ** p < 0.01.

Table 3.25
Sample 1
Baseline Familial Characteristics†

Characteristics at Enrollment	Baseline Sample (n = 1203)	Respondents (n = 746)	Non-Respondents (n = 457)	
Low Maternal Education (% < high - school)	25.7	23.5	31.6	*
Maternal Depression (%)	2.9	3.2	2.3	
Parenting Practices, m (SD)	21.1 (7.1)	20.9 (7.1)	21.7 (6.9)	
Social Provisions, m (SD)	81.5 (10.2)	81.8 (9.9)	80.7 (11.5)	
Family Dysfunction, (%)	9.1	10.0	7.0	
Low Income (% < $15,000 per year)	4.9	4.3	6.3	
Single - parent (%)	27.0	23.3	35.2	

† Statistically significant difference between respondents and non - respondents:
* $p < 0.05$; ** $p < 0.01$.

variable. Accordingly, the presence of the symptom variable is standardized to reflect extreme symptom scale scores relative to grade - mates. Table 3.26 shows the symptom scale cutpoints used for ODD, CD and ADHD (for completeness) broken down by sample (1 or 2), grade at enrollment (junior kindergarten; senior kindergarten and grade one) and informant (teacher; parent) for each sample. It might be expected that scale cut - points for ODD and CD would rise with grade given that the frequency of endorsement of the items on this scale should rise with age, but this is not evident in the Table. The ODD cut - points for teacher informant are usually lower than for parent informant. CD cut - points are similar for teachers and parents. For ADHD there is a trend (based on visual inspection) for cut-points to increase from junior kindergarten to grade one; teacher cut-points are higher than parent cut-points.

The prevalence rates for the presence of symptoms defined as a scale score ≥ 80th percentile at the 30 month followup are as follows:

	n	%
ODD:	157/717	21.9
CD:	189/713	26.5
ADHD:	155/715	21.7

The difference between the denominator shown above and the sample size of 746 reflects the number of individuals who did not complete a sufficient number of the scale items to allow a scale score to be calculated. The variation in prevalence for the three disorders is a measurement artifact because it was not always possible to select the scale cut - point that corresponded to the 80th percentile. When one cut - point resulted in a prevalence below 20 percent and the next cut - point resulted in a prevalence above 20 percent, the cut - point selected was the one that achieved the prevalence closest to 20 percent.

3.12.1.2 Poor School Performance Scale Cut-point

The presence of poor school performance is defined as a scale score of less than or equal to 2 at the 30 month followup on the teacher report of poor school performance (see Table 3.19). The prevalence was 28 percent. Table 3.27 gives the frequency distribution of scores.

3.12.1.3 Proportion with Study Outcome

Using the above methods, the proportion of the sample with outcome 1 and 2 at the 30 month followup was as follows:

	n	%
Outcome 1. Conduct Problems (ODD):	78/706	10.5
Outcome 2. Conduct Problems (CD):	90/702	12.8

3.12.1.4 Profile of Comorbidity for Each Outcome

Study outcome is defined in terms of comorbid disorder. Table 3.28 shows the profile of comorbidity for outcome one and outcome two. The prevalence of pure disorder is very low: 0.7 percent for outcome one and 1.3 percent for outcome two. The majority of cases (children who possess either outcome one or outcome two) have all three disorders present, that is a scale score ≥ 80 percent on the ODD, CD and ADHD scales (70 percent for outcome one and 58 percent for outcome two).

3.12.2 Study Predictors By Outcome

3.12.2.1 Outcome One: Conduct Problems (ODD Symptoms)

Table 3.29 provides descriptive statistics for the study predictors and outcome 1. For the majority of predictors, the difference shown between the group of children with and without outcome one is statistically significant.

3.12.2.2 Outcome Two: Conduct Problems (CD Symptoms)

Table 3.30 provides descriptive statistics for the study predictors and outcome 2. The findings are similar to those for outcome one. For the majority of

predictors, the difference shown between the group of children with and without outcome two is statistically significant.

3.12.3 Study Predictors: Correlations

Table 3.31 shows the correlation between scores on the symptom, academic achievement and familial functioning variables. For the symptom scale scores, between informant correlations for ODD and CD varied from a low of 0.273 for ODD to a high of 0.308 for CD. The highest correlation between symptom scores and reading achievement was -0.17 for teacher assessed ODD; the highest correlation between symptom scores and arithmetic achievement was -0.16 for parent assessed CD. The correlation between reading and arithmetic achievement scores was 0.62.

The correlation between parent assessed symptoms and maternal depression, family dysfunction, parenting and social provisions was consistently higher than the correlation between these variables and teacher - assessed symptoms. For example, the correlation between maternal depression scores and parent - assessed symptoms was 0.31 (ODD) and 0.33 (CD), but was less than 0.1 for teacher - assessed symptoms. The largest correlation observed was between symptoms and parenting, while the smallest correlation was for symptoms and social support.

The correlations between the familial variables were as follows. Family dysfunction and social support were highly correlated (r = -0.62). This is not surprising given that the items that make up both scales concern the nature of relationships (See appendices 5 and 6). The correlation maternal depression and the three other variables was as follows: parenting, 0.30; family dysfunction, 0.48; and social support, -0.46. The correlation between parenting and family dysfunction was 0.32. Finally, the correlation between social provisions and parenting was the lowest, -0.177. The magnitude of the correlation between

Table 3.26
Presence of Symptoms: Scale Cut-points

a) Oppositional Defiant Disorder

Scale Score (Range)		Teacher (0-18)		Parent (0-18)	
Sample		**1**	**2**	**1**	**2**
Baseline	jk	6	6	8	8
	sk	5	5	7	7
	g1	7	6	8	8
6 Months	jk	7	7	7	6
	sk	6	6	7	7
	g1	7	7	7	7
18 Months	jk	5	5	7	6
	sk	5	5	7	7
	g1	7	7	8	8
30 Months	jk	5	5	7	7
	sk	6	6	7	7
	g1	8	8	7	8

Table 3.26 (Cont'd)
Presence of Symptoms: Scale Cut-points

b) Conduct Disorder

Scale Score (Range)		Teacher (0-18)		Parent (0-24)	
Sample		**1**	**2**	**1**	**2**
Baseline	jk	2	2	3	3
	sk	2	2	3	3
	g1	3	2	3	3
6 Months	jk	3	3	2	2
	sk	3	3	2	2
	g1	3	3	2	2
18 Months	jk	2	2	2	2
	sk	2	2	2	2
	g1	3	3	2	2
30 Months	jk	2	2	2	2
	sk	2	2	2	2
	g1	2	2	2	2

Table 3.26 (Cont'd)
Presence of Symptoms: Scale Cut-points

c) Attention-deficit Hyperactivity Disorder

Scale Score (Range)		Teacher (0-28)		Parent (0-28)	
Sample		**1**	**2**	**1**	**2**
Baseline	jk	14	14	13	13
	sk	12	12	13	13
	g1	16	15	14	14
6 Months	jk	14	14	13	13
	sk	14	14	13	13
	g1	17	17	14	14
18 Months	jk	13	13	12	12
	sk	15	15	12	12
	g1	17	17	13	13
30 Months	jk	12	12	12	12
	sk	15	15	13	13
	g1	14	14	13	13

Table 3.27
Poor School Performance: Distribution of Scale Scores

Frequency of Response at Time 4	n, %
1. Far below grade	48, 6.7
2. Somewhat below grade	153, 21.3
3. At grade level	333, 46.3
4. Somewhat above grade	150, 20.8
5. Far above grade	36, 5.0

Table 3.28
Profile of Comorbidity

	Outcome	
	1	2
Presence of:*	n (%)	n (%)
ODD	5 (0.7)	na**
CD	na	9 (1.3)
ODD, CD	16 (2.3)	16 (2.3)
ODD, ADHD	5 (0.7)	na
CD, ADHD	na	13 (1.9)
ODD, ADHD and CD	52 (7.4)	52 (7.4)
Proportion with Outcome	10.5 (78/706)	12.8 (90/702)

* Presence is defined as a symptom scale score of ≥ 80th percentile.
** na = not applicable

Table 3.29
Outcome 1
Descriptive Statistics for Predictor Variables†

	Outcome		
	Present	Absent	
	m (SD)		
Reading Standard Score (baseline)	79.6 (14.8)	89.4 (14.9)	**
Reading Standard Score (six months)	84.9 (16.7)	95.4 (15.6)	**
Maternal Depression (baseline)	13.9 (10.8)	9.1 (8.2)	**
Maternal Depression (six months)	11.8 (8.6)	9.3 (8.4)	*
Parenting Practices (baseline)	23.3 (7.7)	20.7 (6.9)	**
Social Provisions (baseline)	78.4 (10.9)	82.1 (9.8)	*
Family Dysfunction (baseline)	21.3 (6.7)	19.9 (5.3)	
Family Dysfunction (six months)	21.6 (6.4)	19.7 (5.4)	**
	N (%)		
Symptom Scale Score (% > 0)			
ODD (baseline)	67 (88.2)	359 (60.3)	**
ODD (six months)	70 (90.9)	367 (84.0)	**
ADHD (baseline)	74 (97.4)	463 (77.7)	**
ADHD (six months)	72 (93.5)	471 (76.6)	**
ODD Persistent	32 (43)	86 (15)	**
ADHD Persistent	37 (49)	74 (13)	**
ODD Pervasive	25 (33)	66 (11)	**
ADHD Pervasive	21 (28)	45 (8)	**
Low Maternal Education (% < high - school)	19 (29)	132 (23)	
Gender (male)	63 (81)	317 (51)	**
Low Income (< $15,000 per year)	6 (8)	22 (4)	

† Statistically significant difference: * $p < 0.05$; ** $p < 0.01$

Table 3.30
Outcome 2
Descriptive Statistics for Predictor Variables†

	Outcome	
	Present	Absent
	m (SD)	
Reading Standard Score (baseline)	77.5 (15.8)	89.9 (14.3) **
Reading Standard Score (six months)	83.4 (16.5)	96.1 (15.3) **
Maternal Depression (baseline)	13.62 (10.5)	9.1 (8.2) **
Maternal Depression (six months)	11.9 (8.7)	9.2 (8.4) **
Parenting Practices (baseline)	22.7 (7.4)	20.7 (6.9) *
Social Provisions (baseline)	78.5 (10.4)	82.2 (9.8) **
Family Dysfunction (baseline)	21.3 (6.3)	19.9 (5.3) *
Family Dysfunction (six months)	21.6 (6.1)	19.6 (5.4) **
	N, (%)	
Symptom Scale Score (% > 0)		
CD (baseline)	64 (73.6)	236 (40.8) **
CD (six months)	68 (79.1)	238 (39.8) **
ADHD (baseline)	85 (97.7)	448 (77.1) **
ADHD (six months)	82 (94.3)	457 (76.0) **
CD Persistent	30 (35.7)	72 (12.7) **
ADHD Persistent	39 (45.9)	70 (12.2) **
CD Pervasive	21 (25.0)	54 (9.5) **
ADHD Pervasive	25 (29.4)	(40) 7.0 **
Low Maternal Education (% < high school)	28 (36.4)	123 (21.6) **
Gender (male)	72 (80.0)	306 (50.0) **
Low Income (< $15,000 per year)	6 (7.2)	22 (3.8)

† Statistically significant difference: $p < 0.05$; ** $p < 0.01$

Table 3.31
Correlation Between Independent Variables
a) Symptoms*

	Teacher			
	ODD (baseline)	**ODD (6 months)**	**CD (baseline)**	**CD (6 months)**
Parent				
ODD (baseline)	0.299	–	–	–
ODD (6 months)	–	0.273	–	–
CD (baseline)	–	–	0.294	–
CD (6 months)	–	–	–	0.308

* p (two - tailed) < 0.0001 for all values shown

Table 3.31 (Cont'd)
Correlation Between Independent Variables
b) Symptoms† and Achievement*

Symptoms	Reading Achievement	Arithmetic Achievement
Teacher Report		
ODD	-0.17	-0.10
CD	-0.14	-0.09
Parent Report		
ODD	-0.1	-0.13
CD	-0.13	-0.16

† Baseline assessment
* p (two - tailed) < 0.05 for all values shown

Table 3.31 (Cont'd)
Correlation Between Independent Variables
c) Symptomst and Familial Variables

	Teacher		Parent	
	ODD	**CD**	**ODD**	**CD**
Depression	0.07	0.04	0.31*	0.33*
Parenting	0.14*	0.12*	0.46*	0.39*
Family Dysfunction	0.08	0.06	0.31*	0.29*
Social Support	- 0.06	-0.12*	-0.15*	-0.21*

† Baseline
* p (two - tailed) < 0.05

Table 3.31 (Cont'd)
Correlation Between Independent Variables
d) Familial Variables

	Depression	Parenting	Family Dysfunction	Social Support
Depression	1.0	–	–	–
Parenting	0.3*	1	–	–
Family Dysfunction	0.48*	0.32*	1	–
Social Support	-0.46*	-0.18*	-0.62*	1

* p (two - tailed) < 0.0001

measures is explained in part by the fact that all three scales are completed by the parent.

3.13 Logistic Regression Results

3.13.1 Outcome One: Conduct Problems (Oppositional Defiant Disorder)

Table 3.32 summarizes the logistic regression results for Outcome one. Each model listed achieved a statistically significant value of - 2LogL (model - 2LogL/likelihood - ratio model chi - square) and is discussed in turn below. All other models tested did not achieve statistical significance.

Externalizing Symptoms Alone

One, two and three variable models achieved statistical significance as shown in Table 3.32. The persistence and pervasiveness variables did not enter; nor did an interaction term consisting of gender and a symptom score (ODD and gender or ADHD and gender). The baseline ODD and ADHD symptom score variables were not included in any of the models. The value of R^2 increased from 0.17 for a one variable model to 0.25 for a three variable model.

Single Risk Factor and Externalizing Symptoms

Each of the risk factors tested were significant on their own and in combination with the symptom variables entered into the model. None of the risk factors dropped out following the inclusion of one or more symptom variables. The value of R^2 for the models containing a risk factor alone was small and varied from 0.02 (education and depression) to 0.08 (reading). The value of R^2 for models containing a risk factor and symptoms varied from 0.22 for a model containing education, ADHD (6 month followup) and gender to 0.28 for a model containing reading, ODD (6 month followup), ADHD (6 month followup) and gender.

All Variables Model

The full model (defined as all predictors that entered the model based on the - 2LogL/LR criterion) consisted of ODD (6 month followup), ADHD (six month followup), gender, reading and maternal depression. The value of R^2 achieved with this model, 0.33 was slightly higher than the values achieved with the single risk factor plus symptom model. As can be seen in the Table, the sample size used to test this model was 497 (67% of 746), reflecting the number of cases for whom all the variables needed were available.

3.13.2 Outcome Two: Conduct Problems (Conduct Disorder Symptoms)

Table 3.33 summarizes the logistic regression results for Outcome two. Each model listed achieved a statistically significant value of - 2LogL (model - 2LogL/LR chi-square) and is discussed in turn below. All other models tested did not achieve statistical significance. Overall, the pattern of results was similar to that found with Outcome one. The only exception was that the parenting variable did not remain in any model that contained symptom score variables. Each model is discussed in turn below.

Externalizing Symptoms Alone

One, two and three variable models achieved statistical significance as shown in Table 3.33. Again, the persistence and pervasiveness variables and an interaction term consisting of gender and a symptom score (ODD and gender or ADHD and gender) did not enter the model. As with Outcome one, the baseline ODD and ADHD symptom score variables were not included in any of the models. The value of R^2 achieved was similar to that with Outcome one and increased from 0.16 for a one variable model to 0.26 for a three variable model.

Single Risk Factor and Externalizing Symptoms

All of the risk factors tested were significant on their own and in combination with the symptom variables entered into the model with the exception of the parenting practices variable. This predictor dropped out following the inclusion of one or more symptom variables. The value of R^2 for the models containing a risk factor alone was small and varied from 0.02 (parenting) to 0.13 (reading). The value of R^2 for models containing a risk factor plus symptoms varied from 0.25 for a model containing education, ADHD (six month followup) and gender to 0.31 for a model containing reading, ADHD(six month followup) and gender. Comparison with the findings for Outcome one reveals that among models containing only a risk factor, reading also achieved the largest value of R^2 and that for a model containing a risk factor and symptoms, reading and symptoms also achieved the largest value of R^2.

All Variables Model

The full model (defined as all predictors that entered the model based on the -2LogL/LR chi-square criterion) consisted of ADHD (six month followup), gender, reading, income and maternal depression. The value of R^2 with this model, 0.39 was higher than the values achieved for the single risk factor/symptom model. The sample size used to test this model was 493 (66% of 746), reflecting the number of cases for whom all the variables needed were available.

3.13.3 Outcome One: Predicted Probabilities, Sensitivity and Specificity

Table 3.34 shows the predicted probabilities, sensitivity and specificity for six of the models shown in Table 3.32 for Outcome one: i) ODD alone; ii) ADHD and gender; iii) ODD, ADHD and gender; iv) income, ODD, ADHD and gender; v) reading, ODD, ADHD and gender; vi) ODD, ADHD, gender, reading standard score, maternal depression. Each predicted probability value reflects an

increasing cut-point (predicted probability); the lowest and highest values for the predicted probabilities are shown. Truncation was performed using a value of 0.03 or 0.25, depending on which interval provided at least 20 scale cut-points. When the number of cut-points is less than 20, this means that the number of unique predicted probabilities was less than 20. This was the case for ODD alone and for ADHD and gender. For all other models the number of unique predicted probabilities was greater than the number of cut-points shown. Following the generation of the sensitivities and specificities shown, cross-tabulations of the frequency distribution of all predicted probabilities and the presence of outcome were examined to generate additional values for sensitivity and specificity around the critical values of 50 percent (sensitivity) and 91 percent (specificity). This was done because it is possible that a small shift in the value of the cut-point could result in, for example, an increase in sensitivity but little or no change in specificity.

3.13.4 Outcome One: Receiver Operating Characteristic Curve

Figure 3.6 shows the ROC curves generated for outcome one using the values of sensitivity and specificity shown in Table 3.34 for: i) a one variable model (ODD Score at six months); ii) a three variable model (ODD Score at six months, ADHD Score at six months and gender); iii) a four variable model (Reading, ODD Score at six months, ADHD Score at six months and gender); and iv) a five variable model (ODD score at six months, ADHD score at six months, gender, reading and maternal depression). The area under the curve indicates the magnitude of the overall level of predictive accuracy. Based on visual inspection, the five variable model achieves the highest level of overall predictive accuracy.

Table 3.35 summarizes sensitivity and specificity using the criteria set for this study: a sensitivity of at least 50 percent and a specificity of at least 91

percent (to achieve a positive predictive value of 50 percent in a population with a prevalence of 15 percent). As can be seen, the five variable model provides a gain in sensitivity from 40 percent to 51 percent when specificity is held constant at 91 percent. When sensitivity is set at 50 percent or more, the gain in specificity between the one variable model and the five variable model is from 82 percent to 91 percent. The positive predictive value associated with a specificity of 82 percent and a sensitivity of 55 percent (as shown for in the Table for ODD alone) is 35 percent.

The sensitivities and specificities shown in Table 3.35 can also be evaluated with respect to gains in overall accuracy. The benchmark for comparision is the accuracy that could be obtained through random selection of 15 percent of the population which is 74.5 percent as shown in Table 3.23. The accuracy for a model containing ODD alone is 83.35 when specificity is set at 91 percent; when the criterion is a sensitivity greater than or equal to 50 percent, the corresponding accuracy is 77.95 percent (calculated based on a sensitivity of 55 percent and a specificity of 82 percent as shown in Table 3.35).

3.13.5 Outcome Two: Predicted Probabilities, Sensitivities and Specificities

Table 3.36 shows the predicted probabilities, sensitivity and specificity for five of the models shown in Table 3.33 for outcome 2: i) CD alone; ii) CD, ADHD and gender; iii) reading, ADHD and gender; iv) income, CD and gender; v) ADHD, gender, reading standard score, income and maternal depression. Again, each value reflects an increasing cut-point (that is, value of the predicted probability); the lowest and highest values for the predicted probabilities are shown. As for outcome one, truncation was performed using a value of 0.03 or 0.25, depending on which interval provided at least 20 scale cut-points. The number of unique predicted probabilities was less than 20 for CD alone. For all other models the number of unique predicted probabilities was greater than the

number of cut-points shown. Following the generation of the sensitivities and specificities shown, cross-tabulations of the frequency distribution of all predicted probabilities and the presence of outcome were again examined to generate additional values for sensitivity and specificity around the critical values of 50 percent (sensitivity) and 91 percent (specificity).

3.13.6 Outcome Two: Receiver Operating Characteristic Curve

Figure 3.7 shows the ROC curves generated for outcome two using the predicted probabilities and associated sensitivities and specificities (shown in Table 3.36) for:i) a one variable model (CD Score at six months); ii) a three variable model (CD Score at six months, ADHD Score at six months and gender); iii) a three variable model (Reading, ADHD Score at six months and gender); and iv) a five variable model (ADHD score at six months, gender, reading, income and maternal depression). The area under the curve indicates the magnitude of the overall level of predictive accuracy. Based on visual inspection, the five variable model achieves the highest level of overall predictive accuracy.

Table 3.37 summarizes sensitivity and specificity using the criteria set for this study of a sensitivity of at least 50 percent and a specificity of at least 91 percent (to achieve a positive predictive value of 50 percent in a population with a prevalence of 15 percent). The five variable model provides a gain in sensitivity from 31 percent to 48 percent when specificity is held constant at 91 percent. When sensitivity is set at 50 percent or more, the gain in specificity for a one variable versus a five variable model is from 83 to 90 percent. The positive predictive value associated with a specificity of 83 percent and a sensitivity of 54 percent, as shown in the Table for CD alone is 36 percent. Positive predictive value increases across the range of values of specificity shown until it crosses 50 percent with the five factor model (specificity equals 91 percent). These findings are similar to those for ODD.

Regarding gains in overall accuracy, the accuracy for a model containing CD alone is 83.7 percent when specificity is set at 91 percent; when the criterion is sensitivity greater than or equal to 50 percent, the corresponding accuracy is 78.65 percent (calculated based on a sensitivity of 55 percent and a specificity of 82 percent as shown in Table 3.37). Again, the benchmark for comparision is the accuracy that could be obtained through random selection of 15 percent of the population, 74.5 percent as shown in Table 3.23.

3.14 Discussion

Consensus exists that interventions to prevent conduct disorder and antisocial behaviour should be provided as early as possible. Targeted intervention strategies offer advantages over the provision of care in clinical settings in terms of increased coverage and population health impact and have the potential to be more efficient than universal interventions (Bennett, Lipman, Racine & Offord, 1998a). However, the success of targeted interventions depends upon an accurate method to identify high - risk children. If an accurate risk assessment method is not available, children in need are missed, resources are wasted and children are exposed unnecessarily to the negative effects of labeling. Externalizing behaviour symptoms are a strong predictor of future conduct disorder and antisocial behaviour, but their predictive accuracy in non - clinic populations of kindergarten and grade one children requires clarification. The present study was conducted to address this need and is in two parts. First, a detailed review of existing studies was undertaken to derive estimates of the predictive accuracy of externalizing behaviour symptoms in children in kindergarten and grade one. Second, logistic regression and ROC curve techniques were applied to create predictors of conduct problems based on the presence of externalizing symptoms in kindergarten or grade one using data from the Helping Children Adjust study.

Table 3.32
Logistic Regression Results: Outcome 1
(Conduct Problems Defined Using Oppositional Defiant Disorder Symptoms)

	n	-2 Log Likelihood Intercept Only	Model* (df,p)	R^2
Externalizing Symptoms				
1. ODD (6 months)	692	483.3	60.9 (1, 0.0001)	0.17
2. ODD (6 months) and Gender	692	483.3	80.6 (2, 0.0001)	0.22
3. ADHD (6 months)	692	483.3	70.9 (1, 0.0001)	0.20
4. ADHD (6 months) and Gender	692	483.3	85.4 (2, 0.0001)	0.23
5. ODD (6 months) and ADHD (6 months)	692	483.3	77.4 (2, 0.0001)	0.21
6. ODD (6 months), ADHD (6 months) and Gender	692	483.3	91.9 (3, 0.0001)	0.25
Single Risk Factor and Externalizing Symptoms				
a) Reading and Symptoms				
1. Reading (6 months)	625	429.9	23.7 (1, 0.0001)	0.08
2. Reading, ADHD (6 months) & Gender	613	423.03	80.5 (3, 0.0001)	0.23
3. Reading, ODD (6 months), ADHD (6 months) and Gender	613	423.03	84.5 (4, 0.0001)	0.28
b) Income and Symptoms				
1. Income	660	450.7	11.7 (1, 0.0006)	0.04
2. Income, ADHD (6 months) & Gender	648	443.7	86.9 (3, 0.0001)	0.25
3. Income, ODD (6 months), ADHD (6 months) and Gender	648	443.7	94.2 (4, 0.0001)	0.27
c) Maternal Education and Symptoms				
1. Education	649	426.7	4.7 (1, 0.03)	0.02
2. Education, ADHD (6 months) & Gender	639	420.3	72.0 (3, 0.0001)	0.22
d) Maternal Depression and Symptoms				
1. Depression (6 months)	648	464.4	5.3 (1, 0.021)	0.02
2. Depression, ODD (6 months) & Gender	638	457.9	84.7 (3, 0.0001)	0.24
3. Depression, ODD (6 months), ADHD (6 months) and Gender	638	457.9	92.4 (4, 0.0001)	0.26

* -2LogL Model corresponds to the difference in -2LogL between a model with the intercept only and a model containing the intercept and all the covariates being tested; see section 3.10.2.

e) Parenting and Symptoms				
1. Parenting	652	461.3	8.6 (1, 0.0033)	0.03
2. Parenting, ADHD (6 months) & Gender	642	454.8	82.6 (3, 0.0001)	0.24
3. Parenting, ODD (6 months), ADHD (6 months) and Gender	642	454.8	89.6 (4, 0.0001)	0.26
f) Family Functioning and Symptoms				
1. Family Functioning (FF; 6 months)	649	460.6	7.4 (1, 0.0001)	0.02
2. FF, ODD (6 months) & Gender	640	454.3	81.7 (3, 0.0001)	0.24
3. FF, ODD (6 months), ADHD (6 months) and Gender	640	450.2	86.9 (4, 0.0001)	0.26
g) Social Support and Symptoms				
1. Social Support (SS; time 1)	654	457.7	8.22 (1, 0.0001)	0.03
2. SS, ODD (6 months) & Gender	643	450.9	84.0 (3, 0.0001)	0.24
3. SS, ODD (6 months), ADHD (6 months) and Gender	643	450.9	89.7 (4, 0.0001)	0.26
All Variables Model				
1. ODD (6 months), ADHD (6 months), Gender, Reading Standard Score (6 months), Maternal Depression	497	328.8	85.6 (5, 0.0001)	0.33

Table 3.33
Logistic Regression Results: Outcome 2
(Conduct Problems Defined Using Conduct Disorder Symptoms)

	n	- 2 Log Likelihood Intercept Only	Model* (df,p)	R^2
Externalizing Symptoms				
1. CD (6 months)	684	517.4	60.6 (1, 0.0001)	0.16
2. CD (6 months) and Gender	684	439.4	77.9 (2, 0.0001)	0.20
3. ADHD (6 months)	688	522.3	80.8 (1, 0.0001)	0.21
4. ADHD (6 months) and Gender	688	522.3	95.2 (2, 0.0001)	0.24
5. CD (6 months) and ADHD (time 2)	684	517.4	89.4 (2, 0.0001)	0.23
6. CD (6 months), ADHD (6 months) and Gender	684	517.4	101.9 (3, 0.0001)	0.26
Single Risk Factor and Externalizing Symptoms				
a) Reading and Symptoms				
1. Reading (6 months)	625	485.8	46.4 (1, 0.0001)	0.13
2. Reading (6 months), CD (6 months) and Gender	609	466.2	93.9 (3, 0.0001)	0.27
2. Reading (6 months), ADHD (6 months) and Gender	609	466.2	109.8 (3, 0.0001)	0.31
b) Income and Symptoms				
1. Income	657	498.5	22.0 (1, 0.0006)	0.06
2. Income, ADHD (6 months) & Gender	645	483.6	103.8 (3, 0.0001)	0.28
3. Income, CD (6 months), ADHD (6 months) and Gender	641	478.6	110.7 (3, 0.0001)	0.30
c) Maternal Education and Symptoms				
1. Education	647	472.3	10.3 (1, 0.013)	0.03
2. Education, ADHD (6 months) & Gender	633	456.7	86.5 (3, 0.0001)	0.25
d) Maternal Depression and Symptoms				
1. Depression (6 months)	645	513.9	7.1 (1, 0.0078)	0.02
2. Depression, ADHD (6 months) & Gender	635	499.9	93.8 (3, 0.0001)	0.25
3. Depression (6 months), CD (6 months), ADHD (6 months) and Gender	632	495.3	99.7 (4, 0.0001)	0.27

* -2LogL Model corresponds to the difference in -2LogL between a model with the intercept only and a model containing the intercept and all the covariates being tested; see section 3.10.2.

e) Parenting and Symptoms				
1. Parenting	649	507.7	5.9 (1, 0.015)	0.02
f) Family Functioning and Symptoms				
1. Family Functioning (FF; 6 months)	646	506.8	9.9 (1, 0.0017)	0.03
2. FF (6 months), ADHD (6 months) and Gender	640	496.8	94.1 (3, 0.0001)	0.25
3. FF (6 months), CD (6 months), ADHD (6 months) and Gender	634	492.1	101.9 (4, 0.0001)	0.28
g) Social Support and Symptoms				
1. Social Support (SS; time 1)	651	508.3	10.2 (1, 0.0015)	0.03
2. SS, ADHD (6 months) & Gender	640	493.8	89.6 (3, 0.0001)	0.24
3. SS, CD (6 months), ADHD (6 months) and Gender	637	489.2	96.9 (4, 0.0001)	0.26
Method 3: Full Model				
1. ADHD (6 months), Gender, Reading Standard Score (6 months), Income, Maternal Depression	493	369.1	113.8 (5, 0.00001)	0.39

Table 3.34
Outcome 1:
Predicted Probabilities, Sensitivities and Specificities

a) ODD Alone

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.05)	100	0	100
2	91	40	60
3	87	55	45
4	78	64	36
5	71	70	30
6	65	74	26
7	58	78	22
8	55	82	18
9	48	86	14
10	40	91	9
11	29	93	7
12	25	95	5
13	18	96	4
14	17	97	3
15	14	98	2
16	10	98	2
17	10	99	1
18	8	99	1
19 (0.63)	3	100	0

Table 3.34 (Cont'd)
Outcome 1:
Predicted Probabilities, Sensitivities and Specificities

b) ADHD and Gender

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.03)	100	0	100
2	94	23	77
3	86	51	49
4	78	67	33
5	73	74	26
6	68	81	19
7	51	86	14
8	44	89	11
9	40	91	9
10	38	92	8
11	29	93	7
12	25	94	6
13	18	95	5
14	16	96	4
15	12	97	3
16	8	98	2
17	5	99	1
18 (0.52)	1	99	1

Table 3.34 (Cont'd)
Outcome 1
Predicted Probabilities, Sensitivities and Specificities

c) ODD, ADHD and Gender

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.02)	100	0	100
2	97	27	73
3	91	48	52
4	83	63	37
5	77	74	26
6	71	78	22
7	66	82	18
8	58	85	15
9	56	87	13
10	51	88	12
11	49	89	11
12	48	90	10
13	44	90	10
14	40	91	9
15	36	92	8
16	31	93	7
17	30	94	6
18	29	96	4
19	25	96	4
20	18	96	4
21	17	97	3
22	14	98	2
23	12	98	2
24	10	99	1
25	9	99	1
26	8	99	1
27	8	99	1
28	5	100	0
29 (0.66)	0	100	0

Table 3.34 (cont'd)
Outcome 1:
Predicted Probabilities, Sensitivities and Specificities

d) Income, ODD, ADHD and Gender

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.007)	100	0	100
2	97	35	65
3	86	58	42
4	81	71	39
5	73	79	21
6	66	83	17
7	54	86	14
8	51	89	11
9	50	90	10
10	47	90	10
11	46	91	9
12	39	93	7
13	36	94	6
14	36	96	4
15	26	97	3
16	24	97	3
17	16	97	3
18	11	98	2
19	11	99	1
20	11	99	1
21	9	99	1
22	4	99	1
23	4	100	0
24	3	100	0
25 (0.79)	1	100	0

Table 3.34 (cont'd)
Outcome 1:
Predicted Probabilities, Sensitivities and Specificities

e) Reading, ODD, ADHD and Gender

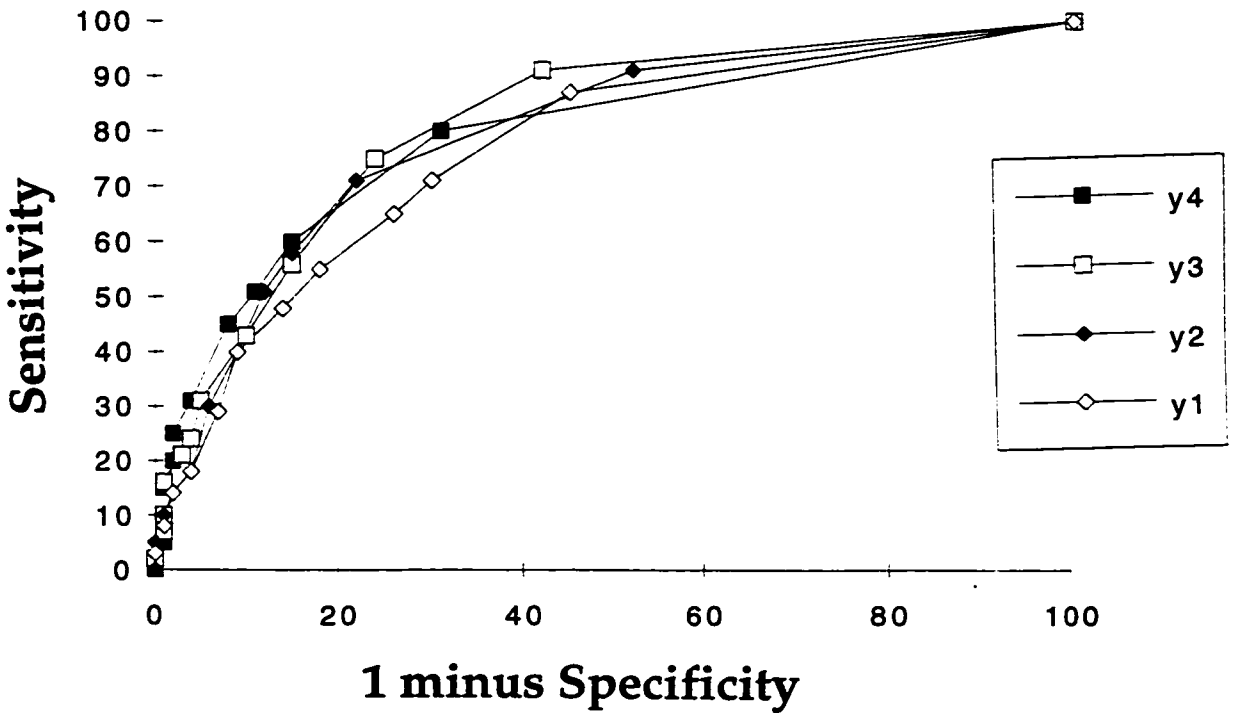
Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.002)	100	0	100
2	97	34	66
3	91	58	42
4	81	71	29
5	75	76	24
6	62	82	18
7	56	85	15
8	50	89	11
9	47	89	11
10	43	90	10
11	38	91	9
12	37	92	8
13	34	94	6
14	31	95	5
15	28	96	4
16	24	96	4
17	21	97	3
18	19	98	2
19	18	98	2
20	16	99	1
21	13	99	1
22	13	99	1
23	13	99	1
24	10	99	1
25	9	99	1
26	7	99	1
27	3	99	1
28 (0.75)	2	100	0

Table 3.34 (cont'd)
Outcome 1:
Predicted Probabilities, Sensitivities and Specificities

f) ODD, ADHD, Gender, Reading Standard Score, Maternal Depression

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.002)	100	0	100
2	100	37	63
3	91	59	41
4	80	69	31
5	77	76	24
6	69	82	18
7	60	85	15
8	55	88	12
9	51	89	11
10	51	91	9
11	45	92	8
12	38	93	7
13	35	95	5
14	31	96	4
15	28	97	3
16	25	98	2
17	20	98	2
18	20	98	2
19	19	99	1
20	15	99	1
21	15	99	1
22	11	99	1
23	9	99	1
24	9	99	1
25	6	99	1
26	5	99	1
27	0	100	0
28 (0.89)	0	100	0

Figure 3.6
Outcome 1:
Receiver Operating Characteristic Curve*



*y = ODD (six months)
y2 = ODD (six months), ADHD (six months) and gender
y3 = Reading, ODD (six months), ADHD (six months) and gender
y4 = ODD (six months), ADHD (six months), gender, reading and maternal depression

Table 3.35
Outcome 1:
Summary of Sensitivities and Specificities

	PPV ≥ 50%		Sensitivity ≥ 50%	
Model	Sensitivity	Specificity	Sensitivity	Specificity
a) ODD	40	91	55	82
b) ADHD, gender	40	91	51	86
c) ODD, ADHD, gender	40	91	51	88
d) Income, ODD, ADHD, gender	46	91	50	90
e) Reading, ODD, ADHD, gender	38	91	50	89
f) ODD, ADHD, gender, reading, maternal depression	51	91	51	91

Table 3.36
Outcome 2:
Predicted Probabilities, Sensitivities and Specificities:

a) CD Alone

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.07)	100	0	100
2	79	60	40
3	65	75	25
4	54	83	17
5	41	89	11
6	31	93	7
7	22	95	5
8	15	98	2
9	8	99	1
10	6	99	1
11	4	99	1
12 (0.83)	2	100	0

Table 3.36 (Cont'd)
Outcome 2:
Predicted Probabilities, Sensitivities and Specificities:

b) CD, ADHD and Gender

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.02)	100	0	100
2	98	22	78
3	95	36	64
4	88	61	39
5	81	71	29
6	76	76	24
7	69	80	20
8	61	84	16
9	57	86	14
10	55	87	13
11	51	90	10
12	43	91	9
13	38	92	8
14	30	93	7
15	28	94	6
16	23	95	5
17	22	96	4
18	21	96	4
19	20	97	3
20	20	98	2
21	20	98	2
22	14	98	2
23	12	98	2
24	12	99	1
25	11	99	1
26	7	99	1
27	5	99	1
28	4	99	1
29 (0.78)	1	99	1

Table 3.36 (Cont'd)
Outcome 2:
Predicted Probabilities, Sensitivities and Specificities:

c) Income, CD and Gender

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.007)	100	0	100
2	99	24	76
3	93	49	51
4	90	60	40
5	80	70	30
6	71	77	23
7	69	81	19
8	65	83	17
9	59	86	14
10	51	87	13
11	47	91	9
12	46	91	9
13	43	92	8
14	40	92	8
15	36	94	6
16	35	95	5
17	31	96	4
18	29	96	4
19	25	96	4
20	19	97	3
21	14	98	2
22	10	99	1
23	6	99	1
24	3	99	1
25 (0.76)	1	99	1

Table 3.36 (Cont'd)
Outcome 2:
Predicted Probabilities, Sensitivities and Specificities:

d) Reading, ADHD and Gender

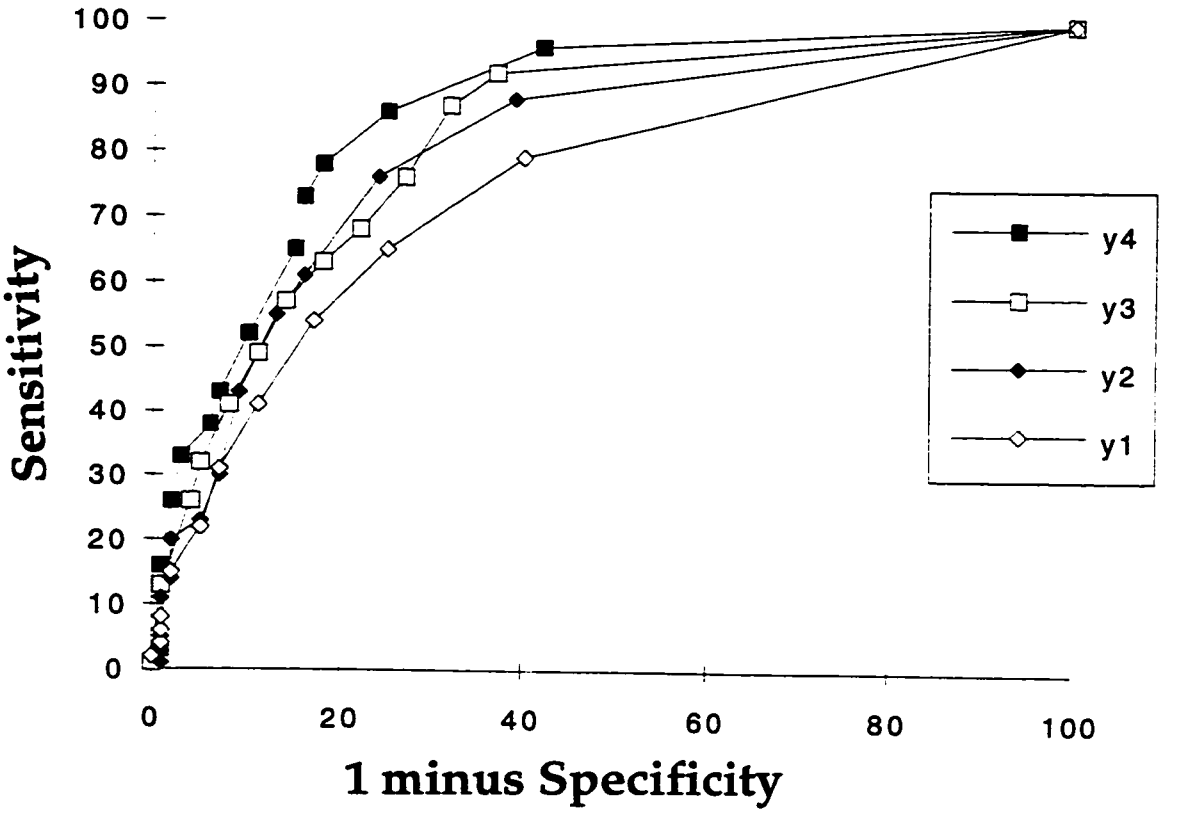
Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.002)	100	0	100
2	99	27	73
3	97	48	52
4	92	63	37
5	87	68	32
6	76	73	27
7	68	78	22
8	63	82	18
9	62	85	15
10	57	86	14
11	51	88	12
12	49	89	11
13	47	91	9
14	41	92	8
15	33	94	6
16	32	95	5
17	28	95	5
18	27	95	5
19	26	96	4
20	19	97	3
21	13	99	1
22	8	99	1
23 (0.82)	1	100	0

Table 3.36 (Cont'd)
Outcome 2:
Predicted Probabilities, Sensitivities and Specificities:

e) ADHD, gender, reading standard score, income, maternal depression

Predicted Probabilities	Sensitivity	Specificity	1 - Specificity
1 (0.0006)	100	0	100
2	100	39	61
3	96	58	42
4	92	70	30
5	86	75	25
6	78	82	18
7	73	84	16
8	58	85	15
9	53	87	13
10	52	90	10
11	48	91	9
12	43	93	7
13	41	93	7
14	38	94	6
15	37	95	5
16	36	96	4
17	33	97	3
18	29	97	3
19	26	98	2
20	23	99	1
21	16	99	1
22 (0.89)	3	99	1

Figure 3.7
Outcome 2:
Receiver Operating Characteristic Curve



*y = CD (six months)
y2 = CD (six months), ADHD (six months) and gender
y3 = Reading, ADHD (six months) and gender
y4 = ADHD (six months), gender, reading, income and maternal depression

Table 3.37
Outcome 2:
Summary of Sensitivity and Specificity

Model	PPV ≥ 50%		Sensitivity ≥ 50%	
	Sensitivity	Specificity	Sensitivity	Specificity
a) CD	31	93	54	83
b) CD, ADHD, gender	41	91	51	90
c) Income, ADHD, gender	46	91	51	87
d) Reading, ADHD, gender	47	91	52	90
e) ADHD, gender, reading, income, maternal depression	48	91	52	90

3.14.1 Main Findings

The findings of this study suggest that the predictive accuracy of externalizing behaviour symptoms in non - clinic populations of kindergarten and grade one children has been over - estimated and highlight the need to discriminate between increased risk and actual risk at the level of the individual child (Bennett, Lipman, Racine & Offord, 1998b). The sensitivity and specificity of the predictors of conduct problems derived in this study using logistic regression and ROC curve techniques are below the levels needed to achieve a coverage of 50 percent or more while at the same time ensuring a PPV of at least 50 percent in populations with an expected prevalence of 15 percent. Moreover, if these two criteria are un - yoked and, for example, PPV is the dominant consideration, then to achieve a PPV of 50 percent approximately 60 percent of children in need will be missed (that is, the level of sensitivity will be only 40 percent). PPV's above 60 percent are associated with sensitivities below 35 percent in this study. Conversely, high sensitivities are associated with low levels of specificity and PPV. These results are consistent with the review of existing studies.

Overall, the findings suggest that the predictive accuracy of externalizing behaviour symptoms in young children is below that proposed by several investigators. The findings also cast doubt on the usefulness of measures of externalizing behaviour symptoms as a risk assessment method in non - clinic populations of kindergarten and grade one children. It is clear that children who possess externalizing behaviour symptoms in kindergarten and grade one are at increased risk for conduct disorder and antisocial behaviour in the future compared to other children. However, the PPV and therefore, prognostic significance of these symptoms at the level of the individual child is low under

the prevalence conditions that exist in non - clinic populations of kindergarten and grade one children.

The duration of follow - up, namely 30 months also effects the level of predictive accuracy found. Olweus has shown that the stability of aggressive behaviour declines as a function of the duration of time between repeated assessments (Olweus, 1979). Therefore, had a longer period of follow - up been possible it is likely that predictive accuracy would be less than that found here. For example, White et al. (1990) reported a PPV of 15 percent in a study with a seven year follow-up period and a five percent prevalence of outcome.

The study results also show that the accuracy of prediction is increased when other risk factors are combined with externalizing symptoms and gender in a predictive index. Small increments in R^2 were obtained as the number of variables included in the index was increased. However, the pre - set criteria for sensitivity and specificity were only achieved by the five variable model. The lack of any major effect of additional variables on estimates of sensitivity and specificity is because the increases in model fit (that is, increases in R^2) do not result in major changes in the number of cases (clinically significant conduct problems) that fall above a given cut - point (value of predicted probability) for the linear predictor.

The data did not suggest that any single risk factor was superior, compared to others in improving prediction. Moreover, the gain in predictive accuracy achieved when other child and family risk factors are combined with externalizing symptoms is small when compared to the effort and cost of collecting the information. One other study evaluated a single risk factor (poor parenting practices) combined with externalizing behaviours but reported that this variable did not make an important contribution to predictive accuracy (Lochman, 1995).

The phenomenon of 'shrinkage' needs to be taken into consideration in interpreting the study findings. The estimates of predictive accuracy reported are based on generalized linear modeling techniques and therefore reflect the 'best fit' model for the data used to develop them (Afifi & Clark, 1996). Consequently, 'shrinkage' will occur when the prediction rules created here are applied to another population and this means that lower levels of predictive accuracy will be obtained.

The six month followup symptom scores consistently entered the models tested and the baseline scores dropped out. This suggests that symptom scores collected from teachers at the end of the school year may be more useful for prediction than those collected at the beginning of the school year. This may be due to the fact that teachers have better knowledge of the children in the spring than in the fall.

3.14.2 Implications for Targeted Interventions

This study shows that a high level of misclassification will occur when high - risk status is designated in kindergarten and grade one using the measures evaluated here. As a result, the population health impact of targeted interventions offered to children in this age group will be diminished. Less than half of the children destined to develop conduct problems will be detected and receive an intervention. Among the children designated to be high risk, 50 percent or more will have little or no need for the intervention they receive and will be exposed unnecessarily to the risks of labeling.

However, targeted interventions may still offer some advantages. For example, compared to clinical services, coverage and public health impact may be increased. It has been estimated that only about 20 percent of children in need of care receive it (Offord et al., 1987; Institute of Medicine, 1994). The present results suggest that this might be increased to as high as 50 percent when the

presence of externalizing symptoms and selected risk factors are used to designate children as high risk. Furthermore, compared to universal programmes, targeted programmes offer a more efficient method of allocating resources. For an outcome with a prevalence of 15 percent, universal programmes provide 85 percent of children with an intervention for which they have little or no need. In contrast, targeted programmes reduce the level of potentially wasted resources to approximately 7.5 percent when, for example, 15 percent of the population is designated as high - risk and provided with an intervention.

3.14.3 Study Methods: Advantages

The methods used in this study offer several advantages when compared to the approaches taken to date. The first concerns logistic regression and ROC curve techniques. The majority of existing studies have evaluated the predictive accuracy of a single, arbitrarily selected predictor scale cut - point. In contrast, the logistic regression and ROC curve methods applied here allow the performance of a predictor to be evaluated across the full range of scale scores, that is, the sensitivity and specificity of all possible values of the predictor (cut - points) can be determined. This approach is attractive because, in the case of non - clinic populations of kindergarten and grade one children, no empirical rationale exists for the selection of a scale cut - point value for measures of externalizing behaviour symptoms and full use is made of the available information. Moreover, logistic regression and ROC curve techniques allow consideration of alternate rules for determining the optimal score for defining test positivity. The rule adopted for this study was unusual in that the goal was not to maximize the likelihood of disorder in a person with a positive test. In contrast, the utility of the linear predictors generated was evaluated in relation to the minimum levels of sensitivity and specificity needed to support recommendations regarding the usefulness of targeted intervention strategies in

kindergarten and grade one children. Logistic regression offers two other important advantages. First, both continuous and discrete variables can be included in a linear predictor and second, two or more variables can be combined to create a risk index.

The prediction rules created in this study are feasible for use in applied settings. A computer is needed that can run a simple programme to enter individual scores for the variables included in the linear predictor and generate a risk classification. This requirement seems reasonable given the widespread availability of computers today and rapidly increasing computer literacy.

A second advantage of the methods used in this study is that the symptom checklist scales used to assess externalizing symptoms are consistent with contemporary DSM diagnostic criteria for the externalizing disorders. Most available studies did not use methods that were linked to psychiatric criteria and those that did used criteria that were developed before DSM - III was published in 1980.

3.14.4 Study Methods: Other Issues

Other aspects of the study methods deserve comment. The first is the study sample. The use of the Tri - Ministry study sample, which consists of a random sample, stratified for risk at baseline is appropriate given the type of analysis conducted. Our purpose was to evaluate the probability of outcome given the presence of certain predictors with the assumption that the relationship between the predictors and the logarithm of the odds of the outcome is linear. Another issue regarding the study sample is loss to follow-up and the influence this may have on the findings. Because of analysis requirements, only respondents who participated in all three of the baseline, six month and 30 month assessments were eligible to be included. This resulted in a 40 percent loss of all respondents who were eligible for inclusion in the subsample used in

the analyses reported here. This level of loss to followup is similar to other prospective followup studies of children in this age group. A comparison of respondents and non - respondents suggests that sample loss may not be random. If the likelihood of being lost to follow - up is higher among those with high levels of the predictor variables and a higher likelihood of developing the study outcome, the effect would be to attenuate predictive accuracy.

The second issue regarding study methods is the approach taken to define the presence of conduct problems at the 30 month assessment. It was not possible to use psychiatric definitions and clinical thresholds of conduct disorder because the prevalence of conduct disorder in the age group studied is too low. However, it was possible to determine the presence of outcome using simple symptom checklist scales that are consistent with contemporary Diagnostic and Statistical Manual (DSM) criteria (namely, DSM III - R) for the externalizing disorders. The outcome definition required the presence of high levels of symptoms (ODD or CD) and impairment (poor school performance). The advantage of this definition is that it is consistent with psychiatric definitions of outcome. In addition, given the low absolute value of symptom scores in this age group, the presence of impairment strengthens the overall face - validity of the outcome classification definition. However, a potential disadvantage is that this approach results in a compound outcome measure made up of two concepts -- externalizing behavioural symptoms and poor school performance. From a methodologic perspective, a measure made up of more than one concept raises the issue of whether the relationship between a given predictor and the outcome is dependent upon the presence of both variables or only one. For example, it could be that when poor school performance is removed from the outcome definition, the relationship between the predictor and the outcome disappears. However, it is not possible to create a definition of outcome that is 'pure' with

respect to the absence of poor school performance because of the correlation that exists between symptom scores and school performance (r = -0.35 at the 30 month assessment). For example, if the presence of outcome was defined as all those with ODD (or CD) scores exceeding the 90th percentile, more than half of the children with scores above the 90th percentile would still have poor school performance. The effect of defining outcomes in terms of symptoms and impairment (poor school performance) rather than symptoms only could be examined by analyzing the data both ways. The results could then be compared to determine whether the magnitude of the relationship(s) observed between the predictor(s) and outcome are sensitive to the presence or absence of poor school performance.

The measurement of impairment was restricted to poor school performance. It is possible that this approach resulted in the exclusion of children who had high symptom scores and impairment in another area, such as problems getting along. A more comprehensive approach to the assessment of impairment was not possible because no measure of overall impairment is available and teacher - reports of problems getting along were not available in the Tri - Ministry data set.

The primary definition of conduct problems was derived using ODD symptoms based on a comparison of: i) the face validity of the items in the ODD and CD scales; and ii) the observed variation of scale scores. The CD scale items have limited face validity in very young children because they reflect severe levels of antisocial behaviour that may not be developmentally appropriate in kindergarten and grade one children. In addition, the variation in CD scale scores in the study sample was less than that for the ODD scale, suggesting that a better level of discrimination between children might be obtained with the ODD

scale. However, the study results show that similar levels of predictive accuracy are achieved with both scales.

The presence of outcome was based on a single assessment at one point in time (the 30 month followup). This approach may result in outcome classification error and this could attenuate the relationship between the predictors and the outcome. For example, outcome classifications based on a single assessment may include individuals whose behavioural symptoms are transient and not clinically important. On the other hand, the symptom scores of individuals who possess the outcome may fluctuate and, as a result, these individuals may be missed in studies where the criterion for outcome is a symptom score above a certain scale cut - point at a single time point.

The reason for assessing the presence of outcome at only one time point relates primarily to the availability of data. As described in section 2.6.3, four assessments were available in the Tri - Ministry data set. Predictors were assessed at the baseline and 6 month followup because it was of interest to evaluate the predictive accuracy of symptom data collected at more than one time point. The 18 and 30 month assessment were therefore available for the assessment of outcome. One alternative considered was to derive the presence of outcome using both the 18 and 30 month assessment data. This option is attractive because it incorporates persistence into the definition of outcome and therefore may decrease error in classifying children with respect to the presence of outcome (Moffitt, 1993). However, this approach resulted in a low rate of outcome events. The decision was therefore to define outcome at the 30 month followup which had the advantage of providing the longest followup period.

The third issue concerning the study outcome is the choice of informant. This study uses teacher - reports of conduct problems because the objective is to develop a risk assessment method that can be used in conjunction with

interventions that aim to modify outcomes that occur in the school setting. An informant - specific approach to risk assessment limits the potential for generalizability of the effects of school - based interventions to conduct problems that occur in the home setting, for example. This is because there is relatively little overlap between the group of teacher - identified high - risk children and the group of children identified by parents as high - risk (Achenbach, McConaughy & Howell, 1987; Offord et al., 1996a). Consequently, when risk status and receipt of an intervention is based on teacher - identified problems, the majority of those children destined to develop conduct problems in the home setting will not be recipients of the intervention. The use of pervasive outcomes (that is, the presence of outcome identified by both the parent and teacher) would address this problem, but would omit the majority of children who are at risk for teacher - identified outcomes. Hence, choice of informant for identifying high - risk children has significant implications for the generalizability of the effects of targeted intervention programmes

A fourth issue concerns the predictor variables evaluated. It is possible that other risk factors may have resulted in a higher level of predictive accuracy. For example, other child characteristics such as neuropsychological functioning have been associated with increased risk for conduct disorder (Moffitt, 1993; Institute of Medicine, 1994). Moreover, it may be that aspects of parent or family functioning that are not reflected in the content of the measures used here may result in higher levels of predictive accuracy. For example, the measure of parenting practices focused on discipline and the success of strategies used by the parent. Although the questions attempt to identify the occurrence of harsh and aggressive tactics, it may be that the instrument does not discriminate well between parents who do and do not use extreme levels of harshness and punitive strategies. A similar point is relevant to the measure of family functioning. This

measure relates primarily to communication and support and does not directly address specific types of interpersonal functioning, such as hostile, aggressive interactions that may predict the development of conduct problems. Finally, the measures used are, by necessity simple and brief and this may limit their ability to discriminate well between individuals. As a result, predictive accuracy may be attenuated.

Choice of informant is also relevant to the selection of externalizing behaviour predictor variables. In general, the use of the same informant for both the predictor and the outcome would be expected to yield higher levels of predictive accuracy than the use of different informants (Achenbach, McConaughy & Howell, 1987). Therefore, teacher - reports of oppositional defiant disorder and attention deficit disorder symptoms were used. It is worth noting that when symptom scale scores based on parent - reports were added to linear predictors containing symptom scale scores based on teacher - reports, their contribution to model fit was not statistically significant.

Multi - collinearity, that is, the lack of independence between the individual predictor variables may also reduce the contribution of a specific predictor variable when it is significantly correlated with those already included in a linear predictor. The predictors evaluated here are known to be correlated. In addition, the magnitude of correlation may be biased upwards due to the methods used. For example, in the present study maternal depression, parenting practices, social support and family functioning are each based on maternal self - report. The correlation observed between ODD and ADHD symptom scores at the six month assessment was 0.68; the correlation between maternal depression, parenting practices, social support and family functioning varied from a low of 0.18 for parenting and social support to a high of 0.61 for family functioning and social support.

A final issue regarding the study methods concerns gender. It has been shown that DSM criteria for conduct disorder under - identify females who have important behavioural problems and impaired functioning based on other independent criteria (Zoccolillo, 1993; Zoccolillo, Tremblay & Vitaro, 1996). It follows that the prediction rules developed in this study may under - detect females with important conduct problems. In addition, a higher rate of false positive errors will occur in females because of the lower prevalence of conduct problems in females compared to males. Consequently, the risks associated with labeling will be greater for females than for males. One of the challenges for future research is to devise risk assessment methods for females that yield higher levels of specificity, while at the same time maintaining adequate levels of sensitivity.

3.14.5 Conclusions

Relatively few studies are available that address the question posed in this study. Moreoever, no systematic examination of the predictive accuracy of externalizing behaviours has appeared in the literature despite recommendations for risk assessment based on this criterion and calls for an increased emphasis on early intervention to prevent conduct disorder (Reid & Patterson, 1991; Reid, 1993; Yoshikawa, 1994; Campbell, 1995; Coie, 1996). The results show that the positive predictive value of externalizing symptoms in non - referred populations of kindergarten and grade on children is modest and below that claimed in the literature. Consequently, when externalizing behaviours are used to designate risk for targeted interventions in this age group, the level of misclassification is likely to be substantial. Despite the potential for the impact of targeted interventions to be diminished, two advantages become apparent when this approach is compared with the alternatives -- increased coverage and a reduction

in the unnecessary provision of resources. However, these advantages must be balanced against the risks associated with labeling, particularly in females.

The creation of accurate risk assessment methods that meet the needs set out in this study would be of great value to both researchers and society. Substantial evidence exists in support of the potential for children to benefit from the early provision of interventions to prevent conduct problems (Ramey & Ramey, 1992; Zigler, Taussig & Black, 1992). Moreover, the advantages of focusing resources on the sub-group of children most in need is self - evident, as is the need to avoid those not in need receiving interventions unnecessarily. Further investigation of other approaches to risk assessment is needed. Teacher nominations have potential, but this approach has not received much attention with respect to predictive accuracy (Ollendick, Greene, Weist & Oswald, 1990). Another consideration is that it is unrealistic to expect that risk classification based on a single assessment, using methods like those evaluated in this study will be of sufficient accuracy. It is likely that a two - or three - stage method that includes a one - on - one evaluation of individual children will be necessary. The 'cost' of the increased accuracy of this approach needs to be evaluated in relation to the 'cost' and accuracy of the approaches evaluated here. In the meantime, until better methods to establish risk status become available, clinicians and public health specialists who select kindergarten and grade one children for targeted interventions based on the presence of externalizing behaviour will need to consider the trade - offs between the wasted resources and negative effects of labeling associated with missclassifying children as high risk and the public health impact of missing children in need of intervention.

Chapter 4
Pathways Study

4.1 Introduction

Conduct disorder results from a complex interaction of multiple factors that include characteristics of the child, parents, family, peer group, school and community (Offord, 1989a; Institute of Medicine, 1994). Decisions about the content of early prevention interventions are derived from our understanding of causal mechanisms and the specific risk and protective factors that operate in young children. At least four classes of early intervention strategies can be formulated from the risk and protective factors that have been identified. One class focuses on skill enhancement. These interventions consist primarily of competence enhancing strategies for children, their families and/or teachers, for example, reading enrichment programmes, school - wide social skills initiatives, recreation programmes or parenting skills programmes. Examples of other classes of early intervention for conduct disorder include: i) strategies that aim to remediate identified problems in individual children, for example, reading problems; ii) strategies to increase the receipt of specific health and social services by those most in need, for example, nutrition supplements or a fixed number of pre - and post - natal visits for high - risk mothers; iii) strategies that focus on characteristics of the physical environment that may increase the likelihood of antisocial behaviour; and iv) system level changes, for example, expectations regarding behavioural norms, rights and responsibilities.

The present study is concerned with risk factors that might be addressed in skill - based interventions. The specific factors to be investigated are reading and arithmetic achievement, maternal depression symptoms, family functioning, parenting practices and social support. The literature review contained in section 4.2 reveals that important gaps exist in our knowledge about the risk of future

clinically important conduct problems when these factors are present in kindergarten and grade one children in non - clinic populations. First, there are relatively few prospective, followup studies that examine the relationship between possible risk factors in young children and future conduct problems. Second, in the few studies that do investigate risk factors the approach taken is limited with respect to informing decisions about the specific factors that should be the target for early intervention. For example, for familial functioning variables a cumulative risk index made up of as many as 10 different factors is used. The relationship between the individual risk variables, for example maternal depression, parenting practices or family functioning and the presence of outcome is not evaluated. As a result, although the studies show that 'family adversity' increases the risk of future conduct problems, it is not clear whether each of the individual risk variables included in the risk index are worthwhile targets for intervention. Moreover, the measurement of risk factors is weak in some studies because a scale, derived using psychometric criteria is not used. Finally, most studies relate risk factors to the presence of one or more psychiatric disorders. Their relationship with the presence of externalizing disorder or conduct disorder specifically is not reported.

The present study is useful for at least two reasons. First, it adds to our knowledge base by providing information about possible risk factors for conduct problems that can be addressed in skill - based interventions for kindergarten and grade one children in non - clinic populations. A second, but possibly more important reason is that the study provides a systematic examination of intervention planning issues with respect to the selection of risk and protective factors that can be targeted in early interventions in general population samples to prevent conduct disorder. The purpose is to employ an evidence - based approach wherein assumptions are made explicit and related to the evidence

upon which they are based. The result should be a clear and comprehensive consideration of the issues and an increased likelihood of intervention success.

4.2 Etiology of Psychiatric Disorder in Children and Adolescents

This section provides an overview of the following core concepts related to the etiology of psychiatric disorder in children and adolescents: i) risk, protective and prognostic factors; ii) causal mechanisms and developmental pathways; and iii) mediators and moderators.

4.2.1 Risk, Prognostic and Protective Factors

Three types of etiologic factors have been identified: i) risk factors which relate to the onset of disorder; ii) prognostic factors which relate to the persistence of disorder; and iii) protective factors which moderate outcome in the presence of risk or prognostic factors.

Risk factors are identified based on the following two criteria: i) are present prior to the onset of disorder; and ii) are associated with an increased risk for disorder. In order for a risk factor to be considered causal, additional criteria must be met including dose - response, specificity, epidemiologic and biologic ' sense (Koch, 1882; Sackett, Haynes, Guyatt & Tugwell, 1991).

Prognostic factors are variables that operate in the presence of disorder and alter the risk of persistence of disorder. Prognostic factors must meet the following criteria: i) be conceptually distinct from the outcome of interest; and ii) result in an important, statistically significant change in the likelihood of persistence of the outcome.

Protective factors act in the presence of risk or prognostic factors and moderate the risk of onset or persistence by buffering or protecting against the effects of known risk or prognostic factors (Rutter , 1985; Rae - Grant, Thomas, Offord & Boyle, 1989). Hypothesized protective factors include child, family and community factors. A protective factor must meet the three criteria identified

above for a risk factor. However, two additional criteria apply as follows: i) a protective factor must exert its effect in the presence of risk factors; and ii) a protective factor must be distinct from a risk factor, that is, a protective factor is a variable that does not exert an effect across all values of the variable (Rutter, 1985).

A large number of factors have been shown to be associated with the onset and persistence of conduct disorder: i) individual child differences, for example, genetic characteristics, influences during inter - uterine development, birth complications and gender; ii) parent and family functioning, for example parental psychopathology, parenting practices, marital discord, income, family size and structure; iii) school and classroom characteristics; and iv) community characteristics. Several detailed reviews are available which summarize what is known about the relationship between these variables and psychiatric outcomes and, therefore, no review is included here (Offord, 1987, 1989b; Institute of Medicine, 1994). A central question that emerges from the reviews is whether evidence is available that these factors are not only correlates of disorder, but also meet criteria for risk, prognostic and protective factors. Judgments on this issue are provided in the reviews but are often limited by a lack of data from longitudinal studies. This type of information is needed to confirm that a specific factor was indeed present before the outcome occurred. In addition, longitudinal studies are needed to evaluate the magnitude of the relationship between a given factor and an outcome. Estimates from cross - sectional studies may be inflated as a result of the case mix studied and because the presence of the factor may be caused in some part by the disorder. These potential biases can be controlled for in longitudinal designs.

4.2.2 Causal Mechanisms and Developmental Pathways

The mechanisms by which risk, prognostic and protective factors exert their influence have been explained using the metaphor of pathways and have become the focus of a new field of study called developmental psychopathology (Stroufe & Rutter, 1984; Rutter, 1989a; Stroufe, 1989; Egeland, Pianta & Ogawa, 1996). Hypothesized pathways into the early onset of conduct problems have been described by a number of authors (Reid & Patterson, 1991; Hinshaw, 1992; Reid, 1993; Yoshikawa, 1994). These pathways consist primarily of externalizing behavioural symptoms (conduct problems), cognitive functioning (neuro-psychological deficits, learning problems and poor school performance) and familial factors (family dysfunction, marital discord, poor parenting practices, parental psychopathology, socioeconomic disadvantage). Timing (or developmental stage) is key to the etiological significance of a given factor. For example, family factors are of central importance in the early years of child development, but peer factors may take precedence in late childhood and early adolescence. Finally, evidence is available that suggests that the factors that determine the onset of disorder are not the same as those that determine persistence (Cohen & Brook, 1987; Offord et al., 1992).

4.2.3 Mediators and Moderators

It is important to distinguish between mediated and moderated effects in conceptualizations and empirical tests of possible causal models (Baron & Kenny, 1986; Holmbeck, 1997). A moderator is a variable that interacts with a predictor variable. The result is that the effect of the predictor variable depends upon the level of the moderator variable. In contrast, a mediator variable is a necessary condition for a predictor variable to exert an effect on the dependent variable. That is, ' the independent variable causes the mediator which then causes the outcome' (Shadish & Sweeney, 1991). These terms are used widely in the

literature. However, a recent review has pointed out that there is a lack of consistency in how each term is defined and that the statistical methods used to investigate them are not always appropriate (Holmbeck, 1997).

4.3 Literature Review

This section has two objectives. The first is to review four prospective, epidemiologic, followup studies that have advanced our knowledge about the factors that influence the onset and course of conduct disorder and antisocial behaviour. The second is to provide a critical summary of prospective studies of children who were first assessed in the kindergarten to grade one age range. The purpose is to summarize what is known about the relationship between the study outcome and academic achievement and familial functioning factors that are present in kindergarten and grade one aged children.

4.3.1 Major Longitudinal Study

Relatively few studies have been conducted that define outcomes using psychiatric classification methods. Even fewer are longitudinal in nature and evaluate factors associated with the onset and persistence of disorder. Much of what we know about the etiology of conduct disorder and antisocial behaviour has been derived from studies of delinquency in males (Robins, 1978; Farrington, 1990; Tremblay, Pihl, Vitaro & Dobkin, 1994). The following discussion presents a summary of the methods and results of four of the most prominent, longitudinal studies that provide information on risk and prognostic factors for conduct disorder and antisocial behaviour. 'Presence of disorder' in the discussion that follows means the presence of one or more psychiatric disorders and may include both externalizing and internalizing disorders.

4.3.1.1 Isle of Wight Studies

The Isle of Wight Study (Appendix 8: Table 1a) was carried out in all 10/11 year - old children who were attending school on the Isle of Wight in 1965

(Rutter, Tizard & Whitmore, 1970). These children were followed up four years later at age 14/15 (Graham & Rutter, 1973). The prevalence of disorder was determined using a two - stage process. First, all children (n = 2199) were assessed using parent - and teacher - completed symptom checklists. Those who scored above a pre - specified cut - point (n = 286) were assessed in stage two to determine the presence of six categories of disorder: conduct disorder; hyperkinetic syndrome; mixed disorder (conduct disorder and neurotic disorder); emotional disorder or child psychosis. The stage two assessment consisted of child and parent interviews by a psychiatrist, information from a teacher self - complete questionnaire and psychological testing.

The overall prevalence of disorder at age 10/11 was 5.7 percent; prevalence at age 14/15 was 7.7 percent. Children with conduct disorder at age 10/11 had the worst prognosis among the individual diagnoses. The stability of disorder is shown in Appendix 8: Table 2a: i) 75 percent of children with conduct disorder at age 10/11 had a psychiatric disorder at age 14/15; ii) 33 percent of children with conduct disorder at age 10/11 had conduct disorder at age 14/15; and iii) 46 percent of children with emotional disorder at age 10/11 had a psychiatric disorder at age 14/15. Psychiatric disorder was associated cross - sectionally with six family variables: severe marital discord, low social status, overcrowding or large family size, paternal criminality, maternal psychiatric disorder and admission of the child to the care of a local authority (Rutter & Quinton, 1977; Rutter, 1989b). The study also showed that there was a strong association between reading problems and conduct problems in 11 year olds. (These findings are reviewed below in section 4.3.2.)

This study has had a major impact on the field, particularly with respect to stimulating further studies regarding: i) the relationship between reading problems and conduct disorder; and ii) risk factors and correlates of psychiatric

disorder in childhood. In addition, the Rutter symptom scales, which were used to screen all children in stage one of the study, have been used widely. However, as is evident in the above, estimates of the prevalence of psychiatric disorder are based on very small numbers of children, the findings regarding risk factors are based on cross - sectional data and the generalizability of the findings beyond the Isle of Wight population is limited. In addition, the diagnostic classification methods are dated. For example, the symptom checklists are limited with respect to coverage of items related to attention - deficit hyperactivity disorder.

4.3.1.2 Cambridge Study of Delinquent Development

This study (Farrington, 1990) was carried out in all eight - year - old boys who were on the register of six schools located within a one mile radius of the study research office in a working class section of London (n = 411). The purpose was to determine the factors associated with the development of delinquency. Boys were assessed at regular intervals from age eight to age 32. Information on a wide variety of variables (as shown in Appendix 8: Table 1b) was collected by interview from the boys as well as their parents, teachers and peers. Factors assessed at age eight and ten that predicted conviction up to the age of 32 were (Appendix 8: Table 2b): i) a high level of troublesome behaviour; ii) convicted parents; iii) low school achievement; iv) poor housing; and v) separated from parents.

Although this study does not focus on psychiatrically defined outcomes, it is useful because it provides detailed followup data on the occurrence and outcomes of specific behaviours that comprise the diagnosis of conduct disorder. The strengths of the study are: i) the life - span approach taken where participants were followed up from a young age in childhood (age 8 to 10) through to adulthood (age 32); ii) completeness of follow-up; and iii) breadth and depth of assessment. The main weakness of the study is that interviews were not

conducted using standardized methods and it is possible that the intensity and breadth of questioning differed between boys who admitted to or had a record of delinquent behaviour and those who did not. Also, the study sample was limited to males who were resident in a working class section of London.

4.3.1.3 Dunedin Multidisciplinary Study of Development

The Dunedin Multidisciplinary Health and Development Study was initiated to investigate the development of a birth cohort of children born in Dunedin, New Zealand in 1972 - 73 (Appendix 8: Table 1c). Children were assessed at regular intervals from age three to fifteen. The presence of psychiatric disorder was determined at age 11 and 15 (conduct or oppositional disorder; attention - deficit disorder; anxiety and depression). Diagnosis at age 11 was based on: i) the results of the Diagnostic Interview Schedule for Children - child report (DISC - C) administered by a single psychiatrist; and ii) psychiatrist review of the DISC - C results and parent and teacher responses to the Rutter symptom scales. At age 15, a modified version of the DISC - C was administered and the presence of disorder was based on this instrument plus parent responses to the Rutter scales (Appendix 8: Table 2c; Williams, Anderson, McGee & Silva, 1987; McGee, Feehan, Williams & Anderson, 1992;). Gender, maternal depression, parent marital status, reading problems and cumulative family disadvantage were associated with the presence of disorder at age 11 as shown in Appendix 8: Table 2c (Williams et al., 1990). However, for several of these variables the definition included repeated assessments between the age of three and 11 and consequently there was overlap in the analysis between the timing of assessment of the risk factors and the presence of psychiatric disorder (age 11). For example, for maternal depression the variable definition included the presence of depression at age 11 which overlapped with the assessment of disorder.

McGee et al. (1992) investigated the presence of psychiatric disorder at ages 11 and 15 using a modified version of the approach used by Williams et al. (1990). The stability of disorder from age 11 to 15 was 42 percent (28 of 66 children who had the presence of at least one disorder at age 11 had a disorder at age 15). All four variables studied (family background composite measure; reading disability; poor social competence; history of behaviour problems) were related to the presence of disorder at age 11 in both males and females. Family background and a history of behaviour problems predicted the persistence of disorder from age 11 to 15 in males only.

In summary, the following points regarding the Williams et al. (1990) and McGee et al. (1992) studies deserve comment. Overall, both studies are consistent with other findings regarding the relation between child, parent and family characteristics and psychiatric disorder. This study is one of the few available that assessed the presence of disorder in a longitudinal design using DSM (III) diagnostic criteria. However, for a number of the variables investigated the study methods do not allow the relationship between variables defined using a unitary concept (rather than a composite measure) and individual psychiatric disorders to be examined. Moreover, the presence of the independent variables was based on multiple time points between ages three and 11 and therefore, the risk associated with their presence in early childhood cannot be determined. Finally, the method used to determine the presence of disorder may not be reproducible and is based on the judgment of only one psychiatrist.

White et al. (1990) and Henry, Moffitt, Robins, Earls, & Silva (1993) used the Dunedin cohort to evaluate the relationship between the presence of a large number of child, parent and family characteristics in early childhood and the presence of antisocial behaviour at age 11/13. These investigators used a

developmental approach to define the presence of antisocial behaviour at age 11/13, as is summarized in Table 1d (Appendix 8). Antisocial behaviour was defined using explicit decision rules and three different instruments (structured interview, symptom checklist and self - report). Moreover, the definition required that antisocial symptoms were persistent over time as well and pervasiveness (more than one informant reported the necessary symptoms). The authors used a series of exploratory analyses to reduce a large pool of variables down to those that were the best predictors of outcome. Child behaviour and motor skills at age three and five were the best child predictors of outcome, as shown in Table 2d (Appendix 8). Parent and family characteristics at age three and five that predicted the presence of antisocial behaviour at age 11/13 in a multiple regression analysis were socio - economic status, mother's reading score and parent agreement on discipline. Hence, these two studies show that specific chacteristics of the child, parent and family in early childhood increase the risk for antisocial behaviour in middle childhood. However, both studies examined a large number of variables and the measurement of many were based on single - item responses to questions that overlapped conceptually with each other (eg, age spoke word, age talked in sentences, number of bad behaviours yesterday, delays obeying parents) rather than psychometric scales designed to evaluate the presence and severity of a particular risk or prognostic factor.

4.3.1.4 Ontario Child Health Study

The Ontario Child Health Study (Appendix 8: Table 1e; Offord et al., 1987; Offord et al., 1992) was a province - wide study designed to determine: i) the prevalence of psychiatric disorder in 4 - to 16 - year-old children; and ii) to evaluate the relationship between other child, parent and family characteristics and the presence of disorder. Children were assessed in 1983 and four years later in 1987. Specially designed parent, teacher and child symptom checklist scales

were used to determine the presence of conduct disorder, hyperactivity disorder and emotional disorder. In addition, parents and teachers completed questionnaires regarding the need for and use of medical and social services, parent and family functioning, child school performance and child involvement in recreational and non - school activities.

The four - year - follow - up (Appendix 8: Table 2e) showed that the stability of conduct disorder (45 percent) was the highest compared to the other two disorders assessed (hyperactivity disorder and emotional disorder). Stability among children who were aged eight to 12 in 1983 was higher than among children who were aged four to seven in 1983. The followup also showed that family dysfunction and problems getting along were associated with the persistence of disorder from 1983 to 1987, while low income predicted the onset of disorder in 1987 in children who were free of disorder in 1983.

The strengths of this study include the representative sampling frame and the investigation of the relationship between individual risk factors and the presence of disorder. A limitation concerns data completeness. In order to conduct the analyses in the followup study only 55 percent of the baseline sample of respondents provided complete data on the variables examined. This problem reflects a generic research challenge in psychiatric epidemiology.

4.3.2 Longitudinal Studies of Children in Kindergarten and Grade One

This section presents a critical review of prospective studies of children who were first assessed in the kindergarten to grade one age range. The purpose is to summarize what is known about the risk associated with academic achievement and familial functioning factors that are present in kindergarten and grade one and future, clinically important conduct problems. Studies that have investigated academic achievement variables will be reviewed first, followed by studies of familial functioning variables.

Very few adequately designed studies of the relationship between academic underachievement and behavioural problems are available. Hinshaw (1992) provides a detailed review of what is known and emphasizes the lack of scientifically adequate data with which to assess the direction of causal relationships. He identifies four alternate hypotheses and summarizes the literature accordingly: academic underachievement causes externalizing behaviour problems; externalizing behaviour problems cause academic underachievement; each variable contributes to the occurrence of the other; and both outcomes are caused by other antecedent variables. Hinshaw concludes that a range of antecedent factors are likely to lead to the development of both behavioural and achievement problems. He also summarizes evidence that suggests that the link between reading/language problems and conduct disorder and antisocial behaviour is through the comorbidity that exists between conduct problems and attention - deficit hyperactivity disorder.

Studies of the relationship between academic achievement and externalizing behaviour in children who were first assessed when they were in the kindergarten to grade one age range have focused on reading problems and language development. Findings from four studies will be reviewed here. The first one is the The Isle of Wight study (Rutter, Tizard & Whitmore, 1970). Although this study was conducted in 11 - year - old children, it is included because the methods and results set the stage for the other three studies that are reviewed below. The Isle of Wight study distinguished between age discrepant and IQ discrepant reading underachievement. Children functioning below the level expected for their age (but not for their IQ) were classified as general reading backward (GRB) and children functioning below the level expected for both age and IQ were classified as having specific reading retardation (SRR). A main finding was a strong association between SRR and antisocial behaviour in

11 - year - olds. Twenty - five percent of SRR children were rated above the cut - off for antisocial behaviour compared to 5 percent in the general population (Rutter, 1974) and conversely, one - third of antisocial children were classed as SRR (Rutter, Tizard & Whitmore, 1970). The pattern of correlates of the group of children classified as SRR and antisocial behaviour was judged to be more similar to the pure SRR group than to the pure antisocial behaviour group. Therefore, it was concluded that reading problems may lead to antisocial behaviour in some cases.

Three other studies are available that meet the following criteria: i) representative, prospective study design of children who were first assessed in the kindergarten to grade one age range; ii) sample includes males and females; and iii) included assessments of language/reading and behaviour. Table 4.1 provides a summary of the measures used in each study at baseline and followup. McGee evaluated the relationship between reading problems and behavioural problems (McGee, Silva & Williams, 1984) using the Dunedin birth cohort. Details of the study design and sample have already been given in section 4.3.1.3. Children who had behaviour problems at age five and age seven were more likely to have reading problems (assessed using the Burt Reading Test) at age seven than children without behaviour problems or with behavioural problems noted at age seven only. Reading/language problems at age five were not included in the design of the study. The results of this study and another one conducted with the same data set, but limited to males lead these authors to conclude that behaviour problems are present prior to the onset of reading problems and that reading problems may exacerbate existing behaviour problems (McGee, Williams, Share, Anderson & Silva, 1986).

The Preschool to School Study (Richman, Stevenson & Graham, 1982a,b) evaluated the relationship between reading and externalizing behaviour.

Representative samples of high (n = 94) and low (n = 91) risk three - year - old children living in the outer London borough of Waldam Forest were assessed and then followed up at age four and eight. Three - year - old children who had low language structure (based on the Reynell Development Language Scales) and no behavioural problems had an increased likelihood of behavioural problems at age 8 compared to children with no language or behaviour problems at age three (Stevenson, Richman & Graham, 1985). However, three - year - old children who had behavioural problems and low language structure did not have an increased likelihood of behavioural problems at age 8 compared to children who had behaviour problems at age 3 only. Therefore, this study suggests that reading problems increase risk for the onset of behaviour problems but do not contribute increased risk once behaviour problems are present.

Jorm also studied the relationship between behaviour problems and reading achievement in 453 Australian children who were assessed in kindergarten, grade one and grade two (Jorm, Share, Matthews & MacLean, 1986). Using the definitions developed in the Isle of Wight Study, children were classified at the end of grade two as either SRR, GRB or normal readers based on the Neale Analysis of Reading Ability and the Columbia Mental Maturity Scale. No baseline assessments of reading/language development were conducted. Children classified as GRB at the end of grade two were found to have significant levels of behavioural problems at all three study assessments compared to normal readers, but children classified as SRR at the end of grade two did not appear to have an excess of behavioural problems compared to normal readers. It was concluded that children who are classified as GRB at the end of grade two have behaviour problems at school entry.

In summary, the available evidence shows that an association exists between externalizing behaviour and reading/language problems in children in

the kindergarten and grade one age range. The Richman study (1982) provides evidence that language problems at age three increase the risk for behaviour problems at age eight in children who are free of behaviour problems at age three. The Jorm et al. (1986) and McGee et al. (1986) studies do not include language/reading measures at baseline. Therefore, although these two studies show a relationship between behaviour problems at baseline and future reading/language problems, the possibility that reading/language problems co-existed with behaviour problems at baseline cannot be ruled out.

The remainder of this section summarizes what is known about the relationship between familial variables and conduct problems in the target age group. Four studies are available; three of them were reviewed in section 4.3.1.3 and are based on the Dunedin birth cohort study (Williams et al.,1990; McGee et al., 1992; Henry et al., 1993). The findings are summarized again here briefly. Table 4.2 provides a summary of the risk factors evaluated in each study. Williams et al. (1990) found that maternal depression, parent marital status (presently a solo parent) and a composite measure of family disadvantage were associated with the presence of disorder at age 11 as shown in Table 4.2 (see also Appendix 8: Table 2c). However, there was overlap between the timing of assessment of maternal depression and the presence of psychiatric disorder and the strength of the relationship for marital status was weak. McGee et al. (1992) showed that the same composite measure of family disadvantage was related to the presence of disorder at age 11 in both males and females. Family disadvantage also predicted the persistence of disorder from age 11 to 15 in males only.

Henry et al. (1993) evaluated 29 parent and family characteristics in early childhood to determine their relationship with the presence of antisocial

Table 4.1
Academic Achievement Risk Factors in Kindergarten and Grade One

	McGee et al. 1984	Richman et al. 1982	Jorm et al. 1986
Baseline Measures			
• Language	–	Reynell Development Language Scales (age 3)	–
• Reading	–	–	–
• Behaviour	Rutter Scales (age 5)	Rutter Scales (age 3)	Rutter Scales (kindergarten)
Followup Measures			
• Language	–	–	–
• Reading	Burt Reading Test (age 7)	–	Neale Analysis of Reading Ability (grade two)
• Behaviour	Rutter Scales (age 7)	Rutter Scales (age 8)	Rutter Scales (grade one) (grade two)

Table 4.2
Familial Functioning Risk Factors†

	Williams et al., 1990	McGee et. al., 1993	Henry et. al., 1993	Richman et al., 1992
Family Demographics				
• SES	na	na	√	na
• Single - parent	√	na	na	na
• Maternal Education (reading score)	na	na	√	na
Familial Functioning				
• Cumulative Disadvantage Index (10 factors)*	√	√***	na	na
• Cumulative Disadvantage Index (3 factors)**	na	na	na	√ (onset)
• Maternal Depression	√	na	x	x
• Parent Agreement on Discipline	na	na	√	na
• Poor Marriage	na	na	na	√ (onset)

†
√ = statistically significant relationship
x = no statistically significant relationship
na = not assessed

* Low socio - economic status, solo - parenting, parental separations, poor maternal mental health, poor family social support, low score on measure of family relations, parents seeking mental guidance, low maternal cognitive ability, mother being young at birth of child, frequent changes of address or school.
** Marriage quality, maternal mental health and level of external stress on family.
*** Onset for both males and females (age 11); persistence (to age 15) males only.

behaviour at age 11/13. Parent and family characteristics at age three and five that predicted the presence of antisocial behaviour at age 11/13 in a multiple regression analysis were socio - economic status, mother's reading score and parent agreement on discipline. Maternal depression at age five did not predict antisocial behaviour.

The fourth study is the Preschool to School Study (Richman et al., 1982a,b). Richman evaluated the influence of maternal depression, poor marriage and family adversity (an index composed of scores for marriage quality, maternal mental health and level of external stress on the family) in her longitudinal study of children from age three to eight. All three factors were associated with the presence of behaviour problems in cross - sectional analyses. Maternal depression did not influence the likelihood of outcome in children with or without behaviour problems at age three. However, in children with no behavioural disturbance at age 3, half of those whose parents reported a poor marriage (at age 3 years) had behavioural disturbance at age 8 compared with only 17 percent of those whose parents reported a satisfactory marriage at age three. In contrast, among children who had a behavioural disturbance at age three (defined as a score of greater than or equal to 10 on the Behaviour Screening Questionnaire), the presence of a poor marriage did not influence the likelihood of the presence of behavioural problems at age eight. A similar result was found for the family adversity index. The authors concluded that family factors were related to the onset of behaviour problems but did not contribute to their persistence in children who were symptomatic at baseline.

The four studies suggest that a relationship exists between familial factors in early childhood and future conduct problems and antisocial behaviour. There is some evidence that maternal depression, a poor marriage and cumulative family disadvantage may increase the risk for behaviour problems. The one

study that showed a relationship between maternal depression and conduct disorder (Williams et al., 1990) can be criticized because depression did not need to pre-date the presence of the outcome; when the definition of depression was limited to assessments conducted prior to age 11 (when the presence of conduct disorder was assessed) the relationship between depression and outcome was much weaker.

4.3.3 Summary

These studies show, using a longitudinal study design that reading/academic achievement and familial factors are associated with an increased risk for the presence of behavioural disorder defined using psychiatric criteria. One study suggests that reading problems may increase risk for the development of behaviour problems. Familial risk factors that are present in early childhood are also associated with future psychiatric disorder. However, three of the four studies reviewed used composite measures of parent and family functioning that combined a number of distinct concepts in a single risk score. For example, the McGee et al. (1993) and Williams et al. (1990) studies defined cumulative disadvantage/family background in terms of multiple variables assessed at multiple time points between age three and eleven (low socio - economic status, solo parenting, parental separations, poor maternal mental health, poor family social support, low score on measure of family relations, parents seeking marriage guidance, low maternal cognitive ability, mother being young at time of birth of the child, frequent changes of address or school). This approach leaves open to question the risk associated with single concept variables measured using a reliable and valid instrument (for example maternal depression, parenting practices, family dysfunction and social support). This information is needed to make judgments about possible causal risk factors and to make decisions about risk factor targets for intervention design.

Finally, these studies suggest that the factors that influence the onset of behaviour problems in young children may differ from those that perpetuate it. This finding is relevant to intervention design because the implication is that different factors should be the target of interventions that aim to reduce onset as opposed to persistence of disorder.

4.4 Study Objectives and Relevance

The study has three objectives. The first is to determine whether reading and arithmetic achievement scores, maternal depression scores, family function scores, parenting practice scores and social support scores are related to the risk of future, clinically important conduct problems. The second objective is to determine whether the relationship between these variables and outcome depends upon the presence of high levels of externalizing behaviour symptoms at the baseline and six month assessment. The third objective is to determine whether the findings depend upon whether teacher - identified or parent - identified conduct problem symptoms are used to define the presence of the study outcome.

The study is relevant to the planning of early intervention strategies in the following ways. First, the study provides additional information on the risk associated with the factors under study for the early onset of conduct problems. As discussed in the literature review, very few prospective studies in a non - referred population of young children are available. No other study is available that uses the present design and relates risk factors assessed in kindergarten and grade one to conduct problem outcomes defined using modern assessment methods that are consistent with DSM - IIIR defined psychiatric symptoms. Moreover, in contrast to existing studies, the assessment of familial variables in this study will be carried out using psychometric scales designed to assess a

unitary concept (for example, maternal depression, parenting practices, family function and social support).

Second, the study addresses the question of whether all kindergarten and grade one children can benefit from the same intervention or whether sub - groups of children with different needs exist. If the relationship between the variables investigated and outcome does not differ between the early and later onset subgroups, then this finding supports the use of interventions with a similar content for all children. However, if the relationship does differ, this would argue for consideration of tailoring intervention content according to the needs of the earlier and later onset subgroups.

Third, if the relationship between the academic achievement and family functioning variables and the study outcome depends upon whether teacher - or parent - identified outcomes are used, then the design of interventions will need to be sensitive to whether the goal is to modify teacher - identified or parent - identified disorder.

4.4 Study Questions

The following three questions will be addressed using data from the Helping Children Adjust: A Tri - Ministry Study.

1. Do academic achievement and familial functioning variables that are present in kindergarten or grade one increase the risk for future conduct problems?
2. Do the academic achievement and familial functioning variables have the same relationship to outcome in subgroups of children defined in terms of early and later onset of conduct problem symptoms?
3. Do the study findings depend on whether parent - or teacher - identified symptoms are used to define outcome?

4.5. Study Design and Sample Size

A prospective, followup study will be conducted. The study design is shown in Figure 4.1. The risk factor variables will be evaluated at baseline and the presence of outcome will be determined based on the six, 18 and 30 month assessments.

4.5.1 Full Sample

Sample 2, as described in section 2.6.3.2 will be used and consists of all Tri - Ministry participants who: i) were in kindergarten or grade one at the time of enrollment (n = 1203); and ii) have complete assessments at baseline, six, 18 and 30 months. Seven hundred and twenty - eight children met these two criteria. The full sample (n = 728) will be used to address question one.

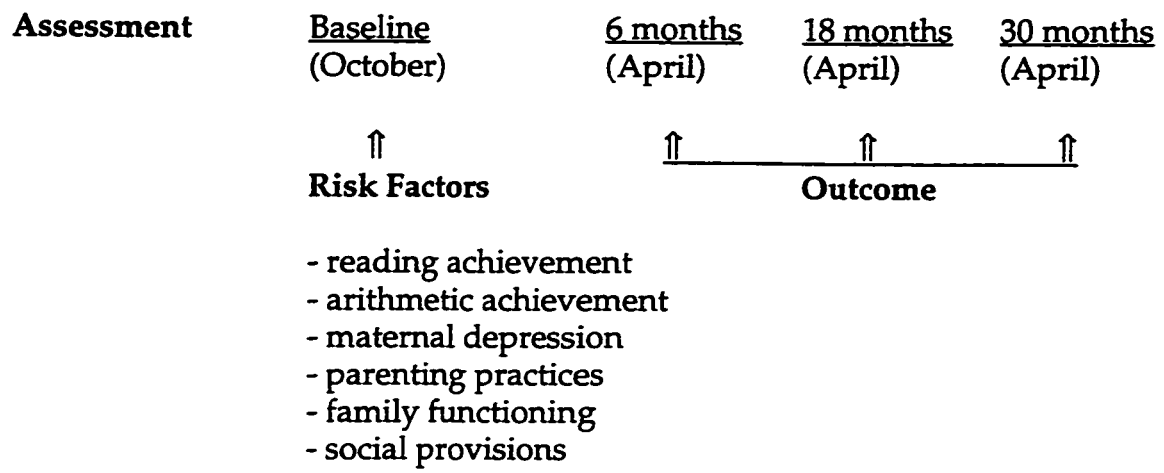
4.5.2 Early Onset and Late Onset Sub - groups

For question two, the full sample will be divided into two sub - groups, namely, an early onset and later onset sub - group. The early onset sub - group will be formed consisting of all those children whose conduct problem symptom scale score (either ODD or CD) at baseline and 6 months is greater than or equal to the 80th percentile. The later onset sample will consist of all the remaining children, that is all children whose conduct problem symptom scale score (either ODD or CD) was not greater than the 80th percentile at both baseline and 6 months. This division results in: i) a group of children who exhibit a consistent pattern of behavioural symptoms in year one of the study; and ii) a group of children who do not exhibit a consistent pattern of behavioural symptoms in year one of the study.

4.6 Study Outcome

The study outcome is clinically important conduct problems. The definition and measurement of this outcome will be the same as that used in the Prediction Study, namely, the presence of conduct problem symptoms and

Figure 4.1
Pathways Study Design



impairment as specified in section 3.8.4. As in the Prediction Study, all analyses will be conducted first using ODD symptom scores and then repeated, substituting CD symptom scores. However, there is one important difference between the Prediction study outcome and the approach to be taken here. In the prediction study, the presence of outcome was based on one assessment at 30 months of followup. In contrast, in the present study, a pathway approach will be taken wherein the presence of outcome will be defined using the six, 18 and 30 month followup assessments as follows. A strict definition of the pathway outcome would require conduct problems to be present at all three assessments. However, with this definition the prevalence of outcome is below 2.5 percent (Table 4.3 shows the proportion of conduct problems in the sample at each of the three time points). Therefore, the presence of the pathway outcome will be defined as the presence of conduct problems on two of the three assessments. Table 4.4 gives the proportion with the outcome for the full sample and for the early and later onset sub - groups which will be used to address question two.

4.7 Independent Variables

The following risk factors will be evaluated: i) academic achievement: reading and arithmetic WRAT standard scores; and ii) familial functioning: maternal depression symptom scores; family functioning score; parenting practices score; and social support.

Measures of parenting practices and social support are available at baseline. Measures of reading achievement, arithemetic achievement, maternal depression and family functioning are available at both baseline and 6 months. The specific scales, content and measurement properties have already been presented in chapter 3. Table 4.5 shows the direction of the scales to aid in the interpretation of the odds ratios presented in the results section.

Table 4.3
Proportion with Conduct Problems
at the Six, Eighteen and Thirty - Month Followup*

	Assessment (Months)		
	6	18	30
	% (N)	% (N)	% (N)
Conduct problems defined using oppositional defiant disorder symptoms.			
• teacher - informant	7.3 (684)	9.8 (703)	10.2 (689)
• parent - informant	6.2 (686)	8.0 (710)	8.0 (69)
Conduct problems defined using conduct disorder symptoms.			
• teacher - informant	8.1 (681)	11.0 (700)	12.5 (686)
• parent - informant	8.2 (686)	9.3 (710)	9.1 (692)

* See section 3.8.4 for the definition and measurement of conduct problems.

Table 4.4
Proportion Meeting Definition for Outcome Pathways

	Informant	
	Teacher	Parent
	% (N)	% (N)
Outcome Pathway 1: (Conduct problems defined using oppositional defiant disorder symptoms)		
• full sample	7.1 (605)	5.3 (640)
• later onset	4.0 (495)	3.2 (538)
• early onset	20.9 (110)	16.7 (102)
Outcome Pathway 2: (Conduct problems defined using conduct disorder symptoms)		
• full sample	9.5 (597)	6.9 (640)
• later onset	5.5 (495)	3.4 (528)
• early onset	29.4 (102)	23.2 (112)

Table 4.5
Direction of Scales for Academic Achievement and Familial Functioning Variables

	High Score
Reading Achievement	Good
Arithmetic Achievement	Good
Maternal Depression	Bad
Family Functioning	Bad
Parenting	Bad
Social Provisions	Good

4.8 Analytic Methods

4.8.1 Data Summary and Descriptive Statistics

Means and proportions will be used to describe the outcome and risk factor variables. Standard deviations and confidence intervals will be calculated as called for. The Student's t test will be used to compare means and the classic Chi - square will be used to compare proportions (Fleiss, 1981). Odds ratios are used to quantify the strength of association between two dicotomous variables and Pearson's correlation co - efficient is used to quantify the relation between two variables measured on a continuous scale. Cohen's kappa is used to quantify agreement.

4.8.2 Logistic Regression

The relationship between the academic achievement and familial functioning variables and the presence of the outcome will be evaluated using logistic regression (Matthews & Farewell, 1988; Afifi & Clark, 1996). The methods are as described in chapter three. However, in the present study the objective is to determine the strength of the relationship between the academic achievement and familial variables and the pathway outcome. Therefore, the results will be interpreted with respect to the odds ratio associated with each variable under study.

Fitting the logistic regression model provides estimates of the β_i (regression coefficients) for each covariate in the model. β_i is the change in ln[odds] of the outcome associated with a one unit change in X_i when the values of each of the other X_i are held constant. The significance of an individual β_i can be assessed using the Wald statistic which has a distribution that is approximately Chi - squared under the null hypothesis that $\beta_i = 0$ (Afifi & Clark, 1996).

Exp β_i is the odds ratio. The interpretation of Exp β_i is as follows. When X_i is discrete, for example, males versus females, Exp β_i is the odds ratio for males (coded 1) versus females (coded 0), with all other X_i fixed. When X_i is continuous, for example age in years then the odds ratio is for x years compared to x - 1 years. The increment in years (or any other continuous variable) can be adjusted according to the needs of the investigator, for example x years versus x - 10 years. This is called the incremental odds ratio. In the present study, the incremental odds ratio will be determined by multiplying the beta - coefficient by an appropriate number of scale points, selected to be 5 in this study. For example, the beta - coefficient for reading achievement will be multiplied by 5 to obtain the odds ratio for a child with a reading achievement standard score of 5 points more than another child. The selection of 5 is arbitrary and is intended to reflect (from the perspective of common sense) a minimum change in scale score that is clinically meaningful and which might be achieved as a result of intervention. This corresponds to approximately one - third of a standard deviation for the reading and arithmetic variables, one - half of a standard deviation for the maternal depression and social provisions scales and about three - quarters to one standard deviation for the parenting and family dysfunction scale. Odds ratios will be determined for each variable alone, and after controlling for gender and symptoms at baseline.

4.9 Sample Characteristics and Completeness

Sample two consists of all children who were in kindergarten or grade one at the time of enrollment and for whom assessments are available at baseline, six, 18 and 30 months. Tables 4.6 and 4.7 show child and familial characteristics for all eligible children at enrollment (n = 1203), all sample two respondents (n = 728) and all sample two non - respondents (n = 475). Only 18 sample one respondents

Table 4.6
Sample 2
Baseline Child Characteristics

Characteristics at Enrollment	Respondents n = 728	Non-Respondents n = 475	
Male/Female (%)	53.4/46.6	54.7 /45.3	
High - risk, N (%)	451 (62.0)	308 (64.8)	
Low - risk, N (%)	277 (38.1)	167 (35.2)	
	m (SD)		
Age (months)	67.7 (10.5)	68.3 (10.7)	
Reading Standard Score Arithmetic	88.5 (15.3)	87.0 (14.5)	
Standard Score	90.5 (19.7)	86.9 (19.0)	**
	N (%)		
Symptom Scale Score > 0			
Oppositional Defiant Disorder			
• parent-identified	648 (89.4)	320 (90.4)	
• teacher-identified	437 (63.0)	216 (67.3)	
Attention - deficit Hyperactivity Disorder			
• parent-identified	653 (90.1)	321 (90.7)	
• teacher-identified	556 (80.0)	273 (85.0)	*
Conduct Disorder			
• parent-identified	445 (61.4)	223 (63.0)	
• teacher-identified	308 (44.6)	157 (49.1)	

† Statistically significant difference between respondents and non - respondents:
* $p < 0.05$; ** $p < 0.01$.

Table 4.7
Sample 2
Baseline Familial Characteristics†

Characteristics at Enrollment	Respondents n = 728	Non-Respondents n = 475	
Low Maternal Education (% < high-school)	23.0	31.9	**
Maternal Depression (%)	3.1	2.5	
Parenting Practices, m (SD)	20.9 (7.0)	21.6 (6.9)	
Social Provisions, m (SD)	81.8 (9.9)	80.5 (11.4)	
Family Dysfunction (%)	9.8	7.6	
Low Income (% < 15,000 per year)	4.3	6.3	
Single-parent (%)	23.4	34.6	**

† Statistically significant difference between respondents and non - respondents:
* $p < 0.05$; ** $p < 0.01$.

did not qualify for this sample. As was the case for sample one (chapter three), there is a trend for non- respondents (families who did not participate at all four time points) to be disadvantaged compared to respondents (families who did participate at all four time points) on some baseline characteristics, suggesting that sample loss was not random. Statistical significance was achieved for the arithmetic standard score, teacher - identified ADHD, maternal education and single - parent status.

4.10 Results

4.10.1 Descriptive Statistics: Teacher - Informant Outcomes

Tables 4.8 and 4.9 contrast children with and without the teacher - identified study outcome according to baseline symptom scores and the academic achievement and familial variables. Table 4.8 shows the results for outcome pathway one (ODD symptoms). Only family dysfunction and maternal education did not achieve statistical significance. Table 4.9 shows the results for outcome pathway two (CD symptoms). Again, only family dysfunction and maternal education did not achieve statistical significance.

4.10.2 Descriptive Statistics: Parent - Informant Outcomes

Tables 4.10 and 4.11 contrast children with and without the parent - identified study outcome according to baseline symptom scores and the academic achievement and familial variables. Table 4.10 shows the results for outcome pathway one (ODD symptoms). Family dysfunction and maternal education did not achieve statistical significance. Table 4.11 shows the results for outcome pathway two (CD symptoms). Only maternal education did not achieve statistical significance .

Table 4.8
Descriptive Statistics: Outcome 1 Pathway (Teacher Informant)†

	Outcome		
	Present n = 43	Absent n = 632	
	m (SD)		
Reading Standard Score (baseline)	78.2 (14.6)	89.1 (14.3)	**
Reading Standard Score (six months)	82.0 (14.30	95.1 (15.2)	**
Arithmetic Standard Score (baseline)	82.1 (19.7)	91.2 (19.1)	
Arithmetic Standard Score (six months)	90.2 (18.20	97.3 (17.2)	**
Maternal Depression (baseline)	13.1 (8.9)	9.5 (8.5)	**
Maternal Depression (six months)	10.4 (6.5)	9.5 (8.5)	*
Family Dysfunction (baseline)	20.9 (6.7)	20.2 (5.4)	
Family Dysfunction (six months)	20.5 (5.7)	19.7 (5.4)	
Parenting Practices (baseline)	22.9 (7.8)	20.9 (7.1)	
Social Provisions (baseline)	77.7 (11.8)	82.0 (9.6)	**
	N (%)		
Symptom Scale Score > 0			
Oppositional Defiant Disorder (baseline)	41 (95.3)	337 (60.0)	**
Oppositional Defiant Disorder (six months)	43 (100.0)	348 (59.1)	**
Low Maternal Education (< high school)	7 (18.4)	129 (23.6)	
Low Income (< $15,000 per year)	13 (31.7)	73 (13.2)	**
Gender (M%/F%)	93/7	51/49	**

†Statistically significant differences: * $p < 0.05$; ** $p < 0.01$.

Table 4.9
Descriptive Statistics: Outcome 2 Pathway (Teacher Informant)†

	Outcome		
	Present n = 59	Absent n = 564	
	m (SD)		
Reading Standard Score (baseline)	77.4 (13.5)	89.5 (14.1)	**
Reading Standard Score (six months)	82.7 (13.3)	95.6 (15.1)	**
Arithmetic Standard Score (baseline)	81.7 (18.6)	91.5 (19.1)	**
Arithmetic Standard Score (six months)	87.3 (18.6)	97.9 (16.8)	**
Maternal Depression (baseline)	12.7 (8.4)	9.4 (8.6)	**
Maternal Depression (six months)	11.4 (6.9)	9.3 (8.5)	*
Family Dysfunction (baseline)	21.1 (5.7)	20.1 (5.5)	
Family Dysfunction (six months)	21.0 (5.4)	19.7 (5.4)	
Parenting Practices (baseline)	22.4 (7.2)	21.0 (7.1)	
Social Provisions (baseline)	77.9 (9.9)	82.2 (9.6)	**
	N (%)		
Symptom Scale Score > 0			
Conduct Disorder (baseline)	43 (75.4)	225 (41.7)	**
Conduct Disorder (six months)	54 (91.5)	222 (39.4)	**
Low Maternal Education (< high school)	17 (33.0)	119 (23.0)	
Low Income (< $15,000 per year)	20 (37.0)	66 (12.4)	**
Gender (M/F)	86/14	51/49	**

†Statistically significant differences: * $p < 0.05$; ** $p < 0.01$.

Table 4.10
Descriptive Statistics: Outcome 1 Pathway (Parent Informant)†

	Outcome		
	Present n = 34	Absent n = 609	
	m (SD)		
Reading Standard Score (baseline)	76.1 (16.3)	89.3 (14.3)	**
Reading Standard Score (six months)	82.7 (12.5)	95.1 (15.3)	**
Arithmetic Standard Score (baseline)	76.8 (18.2)	91.6 (19.2)	**
Arithmetic Standard Score (six months)	84.7 (15.70	97.8 (17.3)	**
Maternal Depression (baseline)	13.7 (10.6)	9.4 (8.4)	**
Maternal Depression (six months)	13.8, (9.9)	9.3 (8.2)	**
Family Dysfunction (baseline)	21.8 (6.2)	20.0 (5.4)	
Family Dysfunction (six months)	21.5 (4.5)	19.7 (5.5)	
Parenting Practices (baseline)	28.1 (6.2)	20.8 (6.9)	**
Social Provisions (baseline)	77.9 (10.7)	82.0 (9.7)	*
	N (%)		
Symptom Scale Score > 0			
Oppositional Defiant Disorder (baseline)	33 (97.1)	540 (89.1)	
Oppositional Defiant Disorder (six months)	33 (97.1)	516 (84.7)	*
Low Maternal Education (≤ high school)	10 (33.0)	126 (22.0)	
Low Income (< $15,000 per year)	13 (38.2)	73 (12.8)	**
Gender (M/F)	82/18	53/47	**

†Statistically significant differences: * $p < 0.05$; ** $p < 0.01$.

Table 4.11
Descriptive Statistics: Outcome 2 Pathway (Parent Informant)†

	Outcome		
	Present n = 44	Absent n = 599	
	m (SD)		
Reading Standard Score (baseline)	75.6 (13.8)	89.6 (14.3)	**
Reading Standard Score (six months)	82.8 (13.7)	95.4 (15.4)	**
Arithmetic Standard Score (baseline)	78.3 (18.1)	91.7 (19.2)	**
Arithmetic Standard Score (six months)	87.5 (17.4)	97.8 (17.2)	**
Maternal Depression (baseline)	14.8 (10.2)	9.3 (8.3)	**
Maternal Depression (six months)	15.3 (9.3)	9.1 (8.1)	**
Family Dysfunction (baseline)	21.8 (5.6)	20.0 (5.5)	*
Family Dysfunction (six months)	22.8 (5.4)	19.6 (5.4)	**
Parenting Practices (baseline)	25.5 (7.6)	20.8 (6.9)	**
Social Provisions (baseline)	76.7 (11.3)	82.1 (9.6)	**
	N (%)		
Symptom Scale Score > 0			
Conduct Disorder (baseline)	43 (97.7)	351 (58.9)	**
Conduct Disorder (six months)	41 (93.2)	322 (53.8)	**
Low Maternal Education (< high school)	10 (25.6)	126 (22.6)	
Low Income (< $15,000 per year)	13 (32.5)	73 (12.9)	**
Gender (M/F)	82/18	52/48	**

†Statistically significant differences: * $p < 0.05$; ** $p < 0.01$.

4.10.3 Presence of Outcome: Agreement Between Parents and Teachers

Table 4.12 summarizes the agreement between parents and teachers on the presence of ODD and CD symptoms defined as scale scores equal to or greater than the 80th percentile. The proportion of children in whom ODD/CD symptoms are present is shown for each of the four study assessments. (The proportions are not equal to 20 percent because it was not always possible to select the scale cut - point that corresponded with the 80th percentile.) The percent of children who were rated by both informants to have ODD/CD symptoms present is also shown. The percent agreement (that is, overlap between parents and teachers) for ODD present is approximately 40 percent. Kappa for overall agreement is low (Fleiss, 1981) and varies from 0.17 to 0.24. The percent agreement for CD present is in the same range; kappa for overall agreement varies from 0.2 to 0.27. Kappa values below 0.40 are consistent with poor agreement (Landis and Koch, 1977).

Table 4.13 shows the agreement between teachers and parents on the presence of the study outcome pathway. For outcome pathway one (ODD symptoms), percent agreement is in the range of 50 percent. The kappa for overall agreement is 0.47. For outcome pathway two (CD symptoms), the percent agreement is similar and the kappa for overall agreement is 0.51. Kappa values between 0.40 and 0.60 are consistent with moderate agreement (Landis and Koch, 1977).

4.10.4 Logistic Regression Results for Questions 1 and 2: Teacher - Identified Symptoms.

The first step was to test each risk factor alone in the full sample of 728 children. Then, logistic regressions were run for each risk factor while adjusting for gender and baseline symptom scores (ODD for pathway one and CD for pathway two). Finally, the risk factors were examined in the early and later

Table 4.12
Presence of ODD and CD Symptoms:
Agreement Between Teachers and Parents

Assessment	Baseline	6 Months	18 Months	30 Months
ODD Present				
N	688	712	711	699
Parent	24.6	27.2	25.7	21.9
Teacher	25.0	21.9	22.5	21.6
Both	10.0	9.1	9.7	8.7
Agreement (%)				
· Parent with teacher	40.6	33.5	37.7	39.8
· Teacher with parent	39.9	41.7	43.0	40.4
Kappa overall	0.21	0.17	0.21	0.24
CD Present				
N	688	708	708	696
Parent	24.4	32.6	26.7	26.3
Teacher	29.5	21.3	22.7	26.3
Both	11.0	10.8	11.1	11.4
Agreement (%)				
· Parent with teacher	45.8	33.0	41.8	43.2
· Teacher with parent	37.9	51.0	49.1	43.2
Kappa overall	0.2	0.2	0.27	0.23

Table 4.13
Presence of Study Outcome:
Agreement Between Teachers and Parents

Outcome Pathway 1	
(n = 630)	
	%
Parent	5.2
Teacher	6.8
Both	3.0
Agreement (%)	
· Parent with teacher	57.6
· Teacher with parent	44.2
· Kappa overall	0.47
Outcome Pathway 2	
(n = 621)	
	%
Parent	6.6
Teacher	9.3
Both	4.4
Agreement (%)	
· Parent with teacher	66.9
· Teacher with parent	46.6
· Kappa overall	0.51

onset subgroups. To avoid confounding the presence of the independent variables with the outcome, the analysis was conducted using baseline data for all variables. Tables 4.14 to 4.20 show the results. Table 4.28 provides a summary of the results shown in Tables 4.14 to 4.20. Each risk factor is listed and then whether or not the variable was statistically significant (shown with an √) is indicated for each of the four analyses conducted. The four analyses were as follows: 1. Risk factor alone, full sample; 2. Risk factor controlling for symptoms and gender, full sample; 3. Risk factor controlling for symptoms and gender, later onset sample; 4. Risk factor controlling for symptoms and gender, early onset sample.

Table 4.14 shows the logistic regression results for each risk factor alone for teacher - identified outcomes for pathway one and pathway two. Reading (baseline and six months), arithmetic (baseline and six months), maternal depression (baseline) and social provisions (baseline) resulted in a statistically signficant - 2LogL model chi - square. The family function and parenting variables were not statistically significant.

As shown in Tables 4.15 to 4.20, the statistically significant relationship for reading and arithmetic achievement, maternal depression and social support remained after adjusting for gender and symptoms, except for social support for pathway two ($p = 0.0659$). (Tables for parenting and family functioning are included for completeness).

Question two regarding early and later onset of symptoms was then addressed. Gender and the baseline symptom score (ODD for pathway one and CD for pathway two) were adjusted for in the analysis. The results are shown in Tables 4.15 to 4.20: beta - coefficient, exp beta, 95 percent confidence interval, incremental exp beta and p (Wald statistic). Table 4.28 provides a summary (columns 3 and 4).

The results reveal a pattern for arithmetic, maternal depression and social support (see Table 4.28 for a summary). Each of these variables is associated with the likelihood of outcome in the later onset group, but not in the early onset group. The results did not depend upon whether ODD or CD symptoms were used to define the outcome. This means that in children who do not show a consistent pattern of behavioural symptoms in the first year of the study, the risk of developing the pathway outcome is influenced by each of the three variables. However, in children who do show a consistent pattern of behavioural symptoms, these variables do not influence the likelihood of outcome. The results for reading did not show this pattern. Reading influenced the likelihood of outcome in both the early and later onset groups. The magnitude of the incremental odds ratios are consistent with a small change in risk.

4.10.5 Logistic Regression Results for Questions 1 and 2: Parent - Identified Symptoms

Again, the first step was to test each of the risk factors alone in the full sample of 728 children. Then, logistic regressions were run for each of the six variables while adjusting for gender and baseline symptom score (ODD for pathway one and CD for pathway two). Finally, the six risk factors were evaluated in the early and later onset subgroups. Again, to avoid confounding the independent variables with the outcome, the analysis was conducted using baseline data for all variables. Tables 4.21 to 4. 27 show the results. Table 4.28 provides a summary of the results shown in Tables 4.21 to 4.27. Each of the six variables is listed and then whether or not each variable was statistically significant (shown with an √) is indicated for each of the four analyses conducted. The four analyses were as follows: 1. Risk factor alone, full sample; 2. Risk factor alone controlling for symptoms and gender, full sample; 3. Risk

factor controlling for symptoms and gender, later onset sample; 4. Risk factor controlling for symptoms and gender, early onset sample.

Table 4.21 shows the logistic regression results for each risk factor alone for parent - identified outcomes for pathway one and pathway two. As can be seen, in contrast to the results for teacher - identified symptoms, all six variables, including the family functioning and parenting variables resulted in a statistically significant model - 2LogL chi - square. For pathway one, five of the six variables are statistically significant; family functioning is not significant. For pathway two, all six variables resulted in a statistically signficant - 2LogL model chi - square.

As shown in Tables 4.22 to 4.27, reading and arithmetic remained statistically significant after controlling for gender and symptoms; this finding held for both pathway one and pathway two. Maternal depression and family functioning were not significant for either pathway once gender and the presence of symptoms at baseline was taken into account. Parenting was statistically significant for pathway one, but not for pathway two. Social support was statistically significant for pathway two, but not for pathway one.

The results for question two regarding early and later onset are shown in Tables 4.22 to 4.27. Reading influenced the likelihood of outcome for both the early and later onset groups for both pathway one and two. This is consistent with the finding for teacher - assessed symptoms. For the remainder of the variables, no pattern of results emerged and the results depended upon whether outcome was defined in terms of ODD or CD symptoms. Arithmetic influenced the likelihood of outcome for both the early and later onset groups for pathway one. This finding is in contrast to the teacher - assessed outcomes, where the influence of arithmetic was limited to the later onset group. However, for pathway two, only arithmetic influenced the likelihood of outcome for the later

Table 4.14
Logistic Regression Results

Teacher Informant

	Pathway 1				Pathway 2			
	n	ß	Exp ß	-2LogL Model, df, p	n	ß	Exp ß	-2LogL Model, df, p
Reading Time 1	560	-0.047	0.95	18.8, 1, 0.0000	554	-0.055	0.95	32.8, 1, 0.0000
Reading Time 2	563	-0.062	0.94	27.6, 1, 0.0000	557	-0.063	0.94	38.2, 1, 0.0000
Arithmetic Time 1	623	-0.025	0.98	8.7, 1, 0.0032	614	-0.027	0.97	13.5, 1, 0.0002
Arithmetic Time 2	628	-0.023	0.98	6.5, 1, 0.0109	619	-0.034	0.97	19.3, 1, 0.0000
Maternal Depression Time 1	587	0.040	1.04	5.87, 1, 0.0154	579	0.038	1.04	6.9, 1, 0.0086
Maternal Depression Time 2	582	-	-	ns	574	-	-	ns
Family Functioning Time 1	576	-	-	ns	568	-	-	ns
Family Functioning Time 2	584	-	-	ns	576	-	-	ns
Parenting Time 1	587	-	-	ns	579	-	-	ns
Social Provisions Time 1	590	-0.039	0.96	6.8, 1, 0.0091	582	-0.041	0.96	9.2, 1, 0.0025

* ß = beta - coefficient; exp ß = odds ratio;
-2LogL Model = -2LogL intercept only - (-2LogL) intercept plus covariates.

Table 4.15
Logistic Regression Results: Reading
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.036	0.96	0.94 - 0.99	0.84	0.0019
	Onset	-0.032	0.97	0.94 - 0.99	0.85	0.0153
	Persistence	-0.055	0.95	0.90 - 0.99	0.76	0.0299
Pathway 2	All	-0.045	0.96	0.94 - 0.98	0.80	0.0000
	Onset	-0.048	0.95	0.93 - 0.98	0.79	0.0002
	Persistence	-0.067	0.94	0.89 - 0.98	0.72	0.0100

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.16
Logistic Regression Results: Arithmetic
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.023	0.98	0.96 - 0.99	0.89	0.0099
	Onset	-0.033	0.97	0.94 - 0.99	0.85	0.0113
	Persistence	-0.010	0.99	0.97 - 1.02	0.95	0.4316
Pathway 2	All	-0.026	0.97	0.96 - 0.99	0.88	0.0014
	Onset	-0.039	0.96	0.94 - 0.98	0.82	0.0005
	Persistence	-0.008	0.99	0.97 - 1.02	0.96	0.5145

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.17
Logistic Regression Results: Maternal Depression
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.051	1.05	1.02 - 1.09	1.29	0.0053
	Onset	0.074	1.08	1.03 - 1.13	1.45	0.0008
	Persistence	0.001	1.00	0.94 - 1.07	1.0	0.9836
Pathway 2	All	0.043	1.04	1.01 - 1.08	1.24	0.0067
	Onset	0.068	1.07	1.03 - 1.12	1.41	0.0018
	Persistence	0.013	1.01	0.96 - 1.06	1.07	0.6137

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.18
Logistic Regression Results: Family Functioning
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.016	1.02	0.98 - 1.06	1.08	0.6040
	Onset	0.004	1.00	0.96 - 1.04	1.02	0.9337
	Persistence	0.034	1.04	0.99 - 1.07	1.19	0.4650
Pathway 2	All	0.022	1.02	0.99 - 1.06	1.12	0.4420
	Onset	0.031	1.03	0.99 - 1.07	1.17	0.3869
	Persistence	0.011	1.01	0.96 - 1.06	1.06	0.8119

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.19
Logistic Regression Results: Parenting
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.0243	1.03	0.99 - 1.07	1.13	0.3155
	Onset	0.0594	1.06	0.99 - 1.11	1.35	0.0772
	Persistence	- 0.0093	0.99	0.94 - 1.07	0.96	0.7890
Pathway 2	All	0.0125	1.01	0.97 - 1.04	1.06	0.5554
	Onset	-0.0065	0.99	0.96 - 1.04	0.97	0.8451
	Persistence	0.0244	1.02	0.98 - 1.05	1.13	0.3770

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.20
Logistic Regression Results: Social Support
Teacher Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.032	0.97	0.94 - 0.99	0.85	0.0474
	Onset	-0.067	0.94	0.89 - 0.98	0.72	0.0064
	Persistence	-0.008	0.99	0.95 - 1.03	0.96	0.7001
Pathway 2	All	-0.028	0.97	0.94 - 1.0	0.87	0.0659
	Onset	-0.051	0.95	0.91 - 0.99	0.78	0.0206
	Persistence	-0.015	0.99	0.95 - 1.03	0.93	0.4634

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.21
Logistic Regression Results
Parent Informant

	Pathway 1				Pathway 2			
	n	ß	Exp ß	-2LogL Model, df, p	n	ß	Exp ß	-2LogL Model, df, p
Reading Time 1	570	-0.055	0.95	21.2, 1, 0.0000	570	-0.060	0.94	30.6, 1, 0.0000
Reading Time 2	573	-0.057	0.95	19.7, 1, 0.0000	573	-0.058	0.94	25.5, 1, 0.0000
Arithmetic Time 1	630	-0.041	0.96	18.4, 1, 0.0000	634	-0.037	0.96	19.3, 1, 0.0000
Arithmetic Time 2	639	-0.040	0.94	17.2, 1, 0.0000	639	-0.032	0.97	13.9, 1, 0.0002
Maternal Depression Time 1	597	0.046	1.05	6.6, 1, 0.0100	597	0.058	1.06	13.5, 1, 0.0002
Maternal Depression Time 2	592	0.051	1.05	7.9, 1, 0.0050	592	0.067	1.07	18.4, 1, 0.0000
Family Functioning Time 1	597	-	-	ns	597	0.059	1.06	4.4, 1, 0.0366
Family Functioning Time 2	594	-	-	ns	594	0.102	1.11	12.7, 1, 0.0004
Parenting Time 1	597	0.155	1.17	34.0, 1, 0.0000	597	0.096	1.10	17.7, 1, 0.0000
Social Provisions Time 1	600	-0.039	0.96	4.9, 1, 0.0261	600	-0.049	0.95	10.9, 1, 0.0010

* ß = beta - coefficient; exp ß = odds ratio;
-2LogL Model = -2LogL intercept only - (-2LogL) intercept plus covariates.

Table 4.22
Logistic Regression Results: Reading
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.0635	0.94	0.91 - 0.97	0.73	.0000
	Onset	-0.0556	0.95	0.91 - 0.98	0.76	.0015
	Persistence	-0.0776	0.93	0.88 - 0.97	0.68	.0032
Pathway 2	All	-0.0602	0.94	0.92 - 0.97	0.74	.0000
	Onset	-0.0776	0.93	0.89 - 0.96	0.68	.0000
	Persistence	-0.0582	0.94	0.91 - 0.98	0.75	.0058

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.23
Logistic Regression Results: Arithmetic
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.0355	0.97	0.95 - 0.98	0.84	0.0006
	Onset	-0.0301	0.97	0.94 - 0.99	0.86	0.0316
	Persistence	-0.0489	0.95	0.92 - 0.99	0.78	0.0055
Pathway 2	All	-0.0297	0.97	0.95 - 0.99	0.86	0.0011
	Onset	-0.0602	0.94	0.91 - 0.97	0.74	0.0001
	Persistence	-0.0111	0.99	0.97 - 1.01	0.95	0.3201

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.24
Logistic Regression Results: Maternal Depression
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.0165	1.02	0.98 - 1.06	1.09	0.4258
	Onset	0.0094	1.01	0.95 - 1.07	1.05	0.7494
	Persistence	0.0230	1.02	0.96 - 1.09	1.12	0.4798
Pathway 2	All	0.0328	1.03	0.99 - 1.07	1.18	0.0691
	Onset	0.0064	1.01	0.94 - 1.07	1.03	0.8442
	Persistence	0.0506	1.05	1.00 - 1.10	1.29	0.0276

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase

Table 4.25
Logistic Regression Results: Family Functioning
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.0026	1.0	0.93 - 1.08	1.01	0.9428
	Onset	0.0071	1.0	0.91 - 1.11	1.04	0.8911
	Persistence	0.0019	1.0	0.90 - 1.11	1.01	0.9728
Pathway 2	All	0.0038	1.0	0.94 - 1.07	1.02	0.9069
	Onset	0.0150	1.02	0.92 - 1.12	1.08	0.7591
	Persistence	-0.0014	0.99	0.92 - 1.09	0.99	0.9758

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.26
Logistic Regression Results: Parenting
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	0.0906	1.1	1.03 - 1.17	1.57	0.0053
	Onset	0.1027	1.11	1.02 - 1.20	1.67	0.0136
	Persistence	0.0725	1.08	0.96 - 1.2	1.44	0.1922
Pathway 2	All	0.0411	1.04	0.99 - 1.1	1.23	0.1159
	Onset	0.0030	1.0	0.92 - 1.09	1.02	0.9407
	Persistence	0.0608	1.06	0.99 - 1.14	1.26	0.0913

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.27
Logistic Regression Results: Social Support
Parent Informant - Adjusting for Symptoms and Gender

		ß	Exp ß	95% CI	Incremental Exp ß	p (Wald)
Pathway 1	All	-0.0259	0.97	0.94 - 1.01	0.88	0.1542
	Onset	-0.0246	0.97	0.93 - 1.02	0.88	0.3024
	Persistence	-0.0354	0.97	0.91 - 1.03	0.84	0.2660
Pathway 2	All	-0.0323	0.97	0.94 - 0.99	0.85	0.0409
	Onset	-0.0365	0.96	0.93 - 1.00	0.83	0.0824
	Persistence	-0.0316	0.97	0.92 - 1.02	0.85	0.1895

* ß = beta - coefficient; exp ß = odds ratio; incremental exp ß = odds ratio for five scale point increase.

Table 4.28

Summary of Logistic Regression Results† *

	Teacher Informant Outcome Pathway								Parent Informant Outcome Pathway							
	ODD				CD				ODD				CD			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Reading	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Arithmetic	√	√	√	x	√	√	√	x	√	√	√	√	√	√	√	x
Maternal Depression	√	√	√	x	√	√	√	x	√	x	x	x	√	(√)	x	√
Family Functioning	x	x	x	x	x	x	x	x	x	x	x	x	√	x	x	x
Parenting	x	x	x	x	x	x	x	x	√	√	√	x	√	x	x	x
Social Support	√	√	√	x	√	(√)	√	x	√	x	x	x	√	√	x	x

† Columns are as follows (√ indicates statistically significant result):

1. Risk factor alone; full sample.
2. Risk factor controlling for gender and symptoms; full sample.
3. Risk factor controlling for gender and symptoms; later onset group.
4. Risk factor controlling for gender and symptoms; early onset group.

* Borderline statistical significance (√):

i) maternal depression, parent - informant, p = 0.066;

ii) social support, teacher informant, p = 0.069.

onset group which is consistent with the finding for teacher - assessed outcomes. Maternal depression influenced the likelihood of outcome for the early onset group for pathway two only. Parenting influenced the likelihood of outcome for the later onset group for pathway one only. Family functioning and social support did not have any effect on the likelihood of outcome for either early or later onset, for either outcome one or outcome two.

4.11 Discussion

Competence enhancing interventions that aim to prevent the early onset of conduct disorder are based on assumptions about the causal mechanisms and risk and protective factors that influence patterns of development in young children. The aim of the present study was to investigate a set of risk factors that can be addressed in skill - based interventions for kindergarten and grade one children in non - clinic populations. The specific objectives were to determine: i) whether the presence of the study outcome is related to reading and arithmetic achievement scores, maternal depression symptoms, parenting practices, family functioning and social support scores; ii) whether the relationship between the risk factors evaluated and outcome depends upon the presence of a high level of conduct problem symptoms at the baseline and six month followup; and iii) whether the relationship between the risk factors evaluated and outcome is informant - specific.

4.11.1 Findings for Teacher - Identified Conduct Problems

In the analyses conducted using teacher - identified conduct problem symptoms, reading and arithmetic achievement, maternal depression and social support influenced the likelihood of outcome. This relationship held when these factors were evaluated alone and after adjusting for the effect of gender and baseline symptom scores. Moreover, the findings did not depend on whether outcome was defined using ODD symptoms or CD symptoms. The magnitude

of the risk increase for each variable was small and fell in the range of a 20 to 40 percent increase in the likelihood of outcome. However, given that the factors evaluated are known to cluster within individuals, an important cumulative risk increase may occur at the level of the individual (Rutter, 1979; Szatmari, Shannon & Offord, 1994; Yoshikawa, 1994). The results are consistent with the studies that have reported a relationship between language problems (Richman et al., 1982a,b) and maternal depression (Williams et al., 1990) and the presence of one or more psychiatric disorders. Family functioning and parenting did not influence teacher - identified outcomes.

A pattern of results emerged from the analysis for the early and later onset group and this finding did not depend upon whether ODD or CD symptoms were used to define conduct problems. Reading, arithmetic, maternal depression and social support were all related to the likelihood of teacher - identified conduct problems in the later onset group. However, in contrast, only reading influenced the likelihood of outcome in the early onset group. There are at least two explanations for this result. First, it may be that conduct problems arise for different reasons in each group, that is, a different underlying causal mechanism is operating. Consequently, children in the later onset group are susceptible to the variables studied here, but children in the early onset group are not. This hypothesis could be explored with variables related to birth complications or neuro - cognitive deficits, for example. If these variables occurred more often in the early onset group than the later onset group and were related to the likelihood of outcome, this would suggest that different causal mechanisms might be operating. Unfortunately, these variables are not available in the present data set. A second explanation is that the two groups represent children at different stages of the natural history of conduct problems. In this case, the same factors are responsible for the onset of disorder in both groups, but their

influence can only be observed in the group of children who are not experiencing high levels of symptoms at the outset of the study. The children who are already experiencing high levels of symptoms are at a later stage in the natural history of the onset of disorder.

Overall, it is unlikely that two distinct, underlying mechanisms are operating. It is most likely that the two groups represent children at different stages in the natural history of disorder. A comparison of the symptom scores of children who developed the outcome in the early onset and later onset group shows that mean scores are similar in both groups. Therefore, there is no indication that the severity of disorder differs between the two groups, which might be the case if different or additional underlying factors were operating. It may be possible that the early onset group is exposed to a greater number of risk factors than the later onset group, but again, this is not reflected in the severity of symptom scores observed in the present study. The findings regarding early and later onset are consistent with the one other study that is available for comparison. As noted in the literature review, Richman et al. (1982a,b) found that the presence of a poor marriage and family adversity increased the likelihood of outcome in the group of children who did not have behaviour problems at age three (presence of behaviour disorder was defined as a score of 10 or more on the Behavioural Screening Questionnaire). However, in the group of children who did have behaviour problems (that is, a score of 10 or more on the Behavioural Screening Questionnaire), these variables had no influence on outcomes.

4.11.2 Findings for Parent - Identified Conduct Problem Symptoms

For parent - identified outcomes, all six variables influenced the likelihood of outcome when they were evaluated alone. However, when gender and baseline symptom scores were adjusted for, the regression coefficients did not

remain statistically significant for all six variables and the results depended upon whether conduct problems was defined using ODD or CD symptoms. For conduct problems defined using ODD symptoms, reading, arithmetic and parenting increased the likelihood of occurrence of the outcome when gender and baseline symptoms were controlled for. Maternal depression, family functioning and social support did not. For conduct problems defined using CD symptoms, reading, arithmetic, maternal depression (borderline significance) and social support increased the likelihood of outcome when gender and baseline symptoms were controlled for. Family functioning and parenting did not. Again, although the magnitude of the risk increase for each variable was small (in the range of a 20 to 40 percent increase in the likelihood of outcome), an important cumulative risk increase may occur at the level of the individual due to clustering of risk factors (Szatmari, Shannon and Offord, 1994; Rutter, 1979). Overall, these findings provide support for the contribution of academic achievement (or underachievement) to the risk of parent - identified conduct problems. However, the results for the familial functioning variables are difficult to interpret because, with the exception of the negative result for family functioning, they depend upon whether ODD or CD symptoms are used to define conduct problems.

4.11.3 Comparison of Results for Teacher - and Parent - Identified Symptoms

The findings for academic achievement did not depend upon whether teacher - or parent - identified conduct problems symptoms were the focus of the analysis. However, the relationships observed between the familial functioning variables and the study outcome were informant - specific. In the analyses conducted in the full sample, maternal depression symptoms and social support increased the likelihood of teacher - assessed outcomes after controlling for gender and baseline symptom score. The results did not depend on whether

ODD or CD symptoms were used to define conduct problems. In contrast, for parent - identified conduct problem symptoms, parenting and social support were statistically significant when gender and baseline symptoms were controlled for, but the relationship depended on whether ODD symptoms or CD symptoms were used in the outcome definition. The relationship between maternal depression and parent - identified outcome, defined using CD symptoms achieved borderline levels of statistical significance. The results of the comparison of early onset and later onset groups were also informant - specific. A pattern emerged when these groups were compared using teacher - assessed conduct problem symptoms but the same pattern was not evident when parent - assessed outcomes were used.

One explanation for the differences found is that it is known that teachers and parents identify different children as disordered. Therefore, it is not surprising that the relationship between the variables investigated here and the study outcome differs between parents and teachers. Relatively little attention has been given in the literature to studies of the factors associated with informant - specific outcomes. Two studies are available in children in the kindergarten to grade one age range (McGee et al., 1983; Gagnon, Craig, Tremblay, Zhou & Vitaro, 1992). In a cross - sectional analysis, McGee et al. (1983) found that high family conflict was present more often in parent - identified disorder than in teacher - identified disorder. Mother's mean psychological symptom score was also higher in parent - identified disorder compared to teacher - identified disorder. Gagnon et al. (1992) did not examine the variables investigated here, but showed a relationship between socio - economic status and teacher - identified disorder. Offord et al. (1996) examined the correlates of teacher - assessed and parent - assessed conduct disorder in a representative sample of six - to sixteen - year - old children and found that parent - assessed conduct

disorder was associated with a depressed parent and family dysfunction, while teacher - assessed conduct disorder was associated with male sex and low income. Further studies are needed to establish a better understanding of the similarities and differences that exist between risk factors for teacher - and parent - identified disorder.

Another point regarding the different results for teacher - and parent - identified conduct problem symptoms is the correlation observed between parent - assessed symptoms and the familial variables. Because these variables are correlated, once symptom levels at baseline are controlled for in the logistic regression analysis, some of the familial functioning variables do not explain any additional variance. This finding does not necessarily mean that these variables do not contribute to the likelihood of parent - assessed outcome, but rather points to the complex relationship that exists between parent - reported child psychiatric symptoms, depression, family functioning, parenting practices and social support. This relationship includes the extent to which bi - directional influences exist between these variables and the role of the response set of the respondent. Not very much is known about the factors that influence parent assessments of behavioural disorder. A recent review of the extent to which the presence of maternal depression distorts mothers perceptions of their child's behaviour concluded that there was little or no evidence available with which to support this argument, primarily because the methodology of existing studies is inadequate (Richters, 1992).

4.11.4 Causal Relationships: Implications of Findings

A 'case for causation' consists of a reasoned argument that applies scientific criteria for causation to the body of available evidence. The objective is to make expert judgments regarding the level of certainty (or uncertainty) that can be attached to a hypothesis about a causal link between a specific variable

and an outcome, or about relationships in a multi - variable theoretical model. Only experimental studies can contribute direct evidence of the extent to which a putative causal factor 'causes' the outcome of interest, because this design allows the investigator to vary exposure to the causal factor and observe the effect on the outcome while controlling for all other factors that might influence outcome. The design of the present study allows certain hypotheses to be 'ruled - out', but because it is a prospective, observational study it can only contribute indirectly to a 'case for causation'.

Regarding reading and arithmetic achievement, a major issue that arises in the interpretation of the present study results, as well as existing ones is that the separate effects of conduct problems and reading (or arithmetic) achievement problems are difficult to evaluate because these variables co - occur and, as a result, are confounded. The present study does not rule out the possibility that conduct problems cause reading or arithmetic achievement problems. Moreover, it may be that the link between reading/arithmetic achievement and the study outcome is due primarily to poor school performance and that there is little or no link with conduct problems. However, the present study does show that achievement and behaviour are linked and that this link is present in early childhood. It seems reasonable to conclude that achievement problems may exert some influence on behaviour but it is likely that this influence is small and represents only one of a number of factors that determine the development of conduct problems. The correlation between achievement scores and conduct problem symptom scores at baseline supports the hypothesis that both problems arise due to other antecedent variables. The present study also does not address the role of ADHD symptoms in the link between reading achievement and conduct problems (Hinshaw, 1992). However, the study does provide evidence of a link between arithmetic achievement and conduct problems and therefore

contributes to an area that has received little attention to date in the literature (Hinshaw, 1992).

Regarding the familial functioning variables, the relationship between maternal depression and teacher - assessed outcome is consistent with the findings of Williams et al. (1990) but is in contrast to Richman et al. (1982a,b) and Henry (1993) who did not find a link between maternal depression and psychiatric outcomes. McGee et al. (1992) did not examine maternal depression separately. The link between maternal depression and the study outcome could be through poor parent - child interaction and/or parenting practices. The link may also be due to a genetically - based predisposition to psychiatric and behavioural disturbance.

The risk increase associated with social support has not been investigated in kindergarten and grade one children or in longitudinal studies of conduct disorder and antisocial behaviour conducted in older children. The mechanism by which social support exerts an influence is likely through an effect on parent - child interactions and parenting practices (Yoshikawa, 1994).

The increased risk associated with maternal depression and social support for teacher - assessed outcome strengthens the argument that these variables may be causally related to conduct problems because teacher assessments of symptoms could not be influenced by these parent - report variables. Moreoever, this finding suggests that the relationship between these variables and parent - assessed outcome cannot be explained solely by the response set of the parent.

Parenting has been established as a risk factor for antisocial behaviour in a number of studies of children over eight - years - of - age (Loeber and Stouthamer - Loeber, 1986; Yoshikawa, 1994). However, both Henry et al. (1993) and Richman et al. (1982a,b) included variables related to parenting practices in their studies, but did not find a relationship with antisocial behaviour at

followup. The present study is consistent with these findings. Further research is required to improve our understanding of the relationship between parenting practices in young children and future conduct problems. This should include measures development with respect to the assessment of parenting practices. Although the measure that was used in this study was derived from the work of Patterson (1982) on parent - child interactions, no information is currently available about its reliability and validity.

4.11.5 Study Methods: Strengths and Limitations

The study has several strengths. First, the risk factors examined all consist of single concepts rather than composite risk indexes. Therefore, the study results are amenable to interpretation regarding the possible causal role of the risk factors evaluated. In addition, conclusions can be drawn regarding the appropriateness of the risk factors as targets for the design of early intervention strategies. Second, the focus of the study was on informant - specific outcomes. Consequently, the results provide a useful guide to the design of interventions aimed at outcomes that are context specific. Moreover, the results provide information on the extent to which risk factors for teacher - and parent - identified outcomes are informant - specific.

Study limitations include the use of a compound outcome measure, the possible limitations of the content of the independent variables, multi - collinearity between the independent variables and the effect of missing data. Each of these issues was discussed in chapter three and therefore, the discussion is not repeated here.

4.11.6 Implications for Intervention Planning

The implications of the study results for intervention planning include the following. First, the results support current theories regarding the role of academic enrichment and support to families in preventing conduct disorder and

antisocial behaviour (Yoshikawa, 1994). Interventions that target academic achievement and mothers (in ways that address the concepts reflected in the maternal depression and social support variables) may result in a decrease in the presence or severity of teacher - assessed conduct problems. Interventions that target academic achievement may also decrease the presence or severity of parent - assessed conduct problems. However, the findings of the present study for parent - assessed outcomes and familial functioning are less clear and would benefit from further investigations that use assessment methods that do not rely solely on parent - reports of the variables under study.

Second, the results suggest that interventions to prevent teacher - identified conduct problems in the kindergarten to grade one age range which focus on maternal depression and social support may only effect children who are not experiencing persistent levels of symptoms (later onset subgroup). Consequently, the population health impact (that is, overall effect size) of the intervention may be diminished because only a small proportion of all children at risk for future conduct problems will benefit from the intervention. Additional strategies will be needed to address the needs of the children already experiencing hihg levels of symptoms and increase the population health impact of the intervention.

Third, the findings suggest that parenting and family functioning variables do not influence teacher - assessed outcomes. Therefore, interventions that target these variables in this age range are unlikely to show any effect on teacher - assessed outcomes.

4.11.7 Conclusions

The results of this study show that academic achievement, maternal depression and social support are related to future conduct problems. However, the relationship between these risk factors and conduct problems is informant -

specific. No relationship was found for family functioning and teacher - or parent - identified conduct problems. Parenting practices were related to parent - identified conduct problems but the results are difficult to interpret because they depend on whether conduct problems are defined using ODD or CD symptoms. Parenting practices were not related to teacher - identified conduct problems.

Skill - based interventions for kindergarten and grade one children that focus on academic achievement and support to mothers may reduce the likelihood of future conduct problems that are present in the school context. Academic achievement interventions may also reduce the likelihood of future conduct problems that are present in the home setting. However, the impact of these interventions may be limited to children who do not have high levels of externalizing behaviour symptoms. This will diminish the overall population health impact of the intervention and points to the need for additional strategies to ensure that the needs of all at - risk children are met.

Several authors have presented compelling arguments for the role of early intervention in the prevention of conduct disorder and antisocial behaviour (Reid, 1993; Yoshikawa, 1994). The theoretical perspectives presented in these arguments are buttressed by epidemiological analyses such as those presented here.

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Appendices

1. Tri-Ministry Study Risk Screening Questionnaire Items (RSQ)
2. Maternal Education
3. Maternal Depression: Centre for Epidemiologic Studies - Depression Scale (CES-D)
4. Parenting Practices
5. Social Provisions Scale
6. Family Dysfunction
7. Socio-economic Disadvantage
8. Chapter Four Literature Review Tables

Appendix 1

Tri-Ministry Study Risk Screening Questionnaire Items (RSQ)

Aggressive, Antisocial Behaviour

1. Easily annoyed by others
2. Blames others for own mistakes
3. Gets in many fights
4. Destroys things belonging to others
5. Steals
6. Swearing or obscene language
7. Lying or cheating
8. Defiant, talks back to adults
9. Angry and resentful
10. Gets back at people
11. Cruelty, bullying meanness to others
12. Does things that annoy others
13. Argues a lot with adults
14. Physically attacks people
15. Threatens people
16. Temper tantrums or hot temper

Withdrawn, Over-compliant Behaviour

1. Fails to stand up for self
2. Used by other kids
3. Bullied by others
4. Too anxious to please
5. Gives in to peers
6. Is teased
7. Defenceless
8. Submissive
9. Overconforms
10. Taken advantage of by peers
11. Picked on by others

Appendix 2
Maternal Education

What is the highest grade or level of education you have ever completed?

(1) No schooling
(2) Some elementary
(3) Completed elementary
(4) Some secondary
(5) Completed secondary
(6) Some Community or Technical college, CEGEP, Nurses' training
(7) Completed Community or Technical college, CEGEP, Nurses' training
(8) Some University or Teacher's college
(9) Completed University or Teacher's college

Appendix 3
Maternal Depression:
Centre for Epidemiologic Studies - Depression Scale (CES-D)

Question (parent self - complete): The following statements describe some of the ways people feel at different times. Please mark the number which best describes how often you felt or behaved this way during the past week.

	Rarely or None of the Time (Less than 1 day)	Some or a Little of the Time (1-2 Days)	Occasionally or a Moderate Amount of Time (3-4 Days)	Most or All of the Time (5-7 Days)
DURING THE PAST WEEK:				
1. I was bothered by things that usually don't bother me.....	0	1	2	3
2. I did not feel like eating: my appetite was poor.....	0	1	2	3
3. I felt that I could not shake off the blues even with help from my family or friends.....	3	2	1	0
4. I felt that I was just as good as other people.....	3	2	1	0
5. I had trouble keeping my mind on what I was doing.....	0	1	2	3
6. I felt depressed.....	0	1	2	3
7. I felt that everything I did was an effort.....	0	1	2	3
8. I felt hopeful about the future.....	3	2	1	0

Appendix 3
Maternal Depression: Centre for Epidemiologic Studies - Depression Scale (CES-D)

9. I thought my life had been a failure.....	0	1	2	3
10. I felt fearful.....	0	1	2	3
11. My sleep was restless.....	0	1	2	3
12. I was happy.....	3	2	1	0
13. I talked less than usual.....	0	1	2	3
4. I felt lonely.....	0	1	2	3
15. People were unfriendly.....	0	1	2	3
16. I enjoyed life.....	3	2	1	0
17. I had crying spells.....	0	1	2	3
18. I felt sad.....	0	1	2	3
19. I felt that people disliked me.....	0	1	2	3
20. I could not get 'going'.....	0	1	2	3

Appendix 4
Parenting Practices

Question (interviewer - administered): I will read out some questions about disciplining your child. Please decide which response best describes your situation and tell me whether it is (1) never, (2) almost never, (3) sometimes, or (4) often. Just tell me the number.

	Never (1)	Almost Never (2)	Some-times (3)	Often (4)
1. If you ask _____ to do something and he/she does not do it, how often do you give up trying to get him/her to do it?				
2. When _____ has done something wrong, how often do you lose your temper toward him/her?				
3. If _____is punished, how often does the punishment work?				
4. If a punishment has been decided upon, how often can _____ get you to change it by explanation, arguments or excuses?				
5. If you punish _____, how often does his/her behaviour get worse?				
6. How often does _____ get away with things?				
7. How often do you feel that it is more trouble than it is worth to ask _____to do something that you want?				
8. How often do you have to spank _____?				
9. How often do you have difficulty controlling _____ ?				
10. How often do you decide not to punish _____ even though he/she broke a rule you had set?				
11. How often do you yell at _____?				

Appendix 4
Parenting Practices (Cont'd)

12. How often does your punishment make _____ behave?
13. How often does _____ manage to get around the rules you set for him/her?
14. When you ask _____ to do something, how often will he/she do it?
15. How often will _____ accept the punishment you have set?
16. How often do you have to threaten _____ with punishment in order to get him/her to do something?
17. When you ask _____ to stop doing something how often will he/she stop?

Appendix 5
Social Provisions Scale

Question (parent self - complete): Below is a list of statements about your relationship with others. Please respond to each statement, indicating your agreement or disagreement. The responses go from strongly disagree to strongly agree.

	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. There are people I can depend on to help me if I really need it.	_____	_____	_____	_____
2. I feel that I do not have any close personal relationships with other people.	_____	_____	_____	_____
3. There is no one I can turn to for guidance in times of stress.	_____	_____	_____	_____
4. There are people who depend on me for help.	_____	_____	_____	_____
5. There are people who enjoy the same social activities I do.	_____	_____	_____	_____
6. Other people do not view me as competent.	_____	_____	_____	_____
7. I feel personally responsible for the well-being of another person.	_____	_____	_____	_____
8. I feel part of a group of people who share my attitudes and beliefs.	_____	_____	_____	_____
9. I do not think other people respect my skills and abilities.	_____	_____	_____	_____
10. If something went wrong, no one would come to my assistance.	_____	_____	_____	_____
11. I have close relationships that provide me with a sense of emotional security and well-being.	_____	_____	_____	_____
12. There is someone I could talk to about important decisions in my life	_____	_____	_____	_____

Appendix 5 (Cont'd)
Social Provisions Scale

	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
13. I have relationships where my competence and skills are recognized.	_____	_____	_____	_____
14. There is no one who shares my interests and concers.	_____	_____	_____	_____
15. There is no one who really relies on me for their well-being.	_____	_____	_____	_____
16. There is a trustworthy person I could turn to for advice if I were having problems.	_____	_____	_____	_____
17. I feel a strong emotional bond with at least one other person.	_____	_____	_____	_____
18. There is no one I can depend on for aid if I really need it.	_____	_____	_____	_____
19. There is no one I feel comfortable talking with about problems.	_____	_____	_____	_____
20. There are people who admire my talents and abilities.	_____	_____	_____	_____
21. I lack a feeling of intimacy with another person.	_____	_____	_____	_____
22. There is no one who likes to do the things I do.	_____	_____	_____	_____
23. There are people I can count on in an emergency.	_____	_____	_____	_____
24. No one needs me to care for them anymore.	_____	_____	_____	_____

Appendix 6
Family Dysfunction

Question (parent self - complete): Next are statements about families and family relationships. Please respond to each statement, indicating the category which describes your family. The responses go from strongly disagree to strongly agree.

	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1. Planning family activities is difficult because we misunderstand each other.	_____	_____	_____	_____
2. In times of crisis we can turn to each other for support.	_____	_____	_____	_____
3. We cannot talk to each other about sadness we feel.	_____	_____	_____	_____
4. Individuals (in the family) are accepted for what they are.	_____	_____	_____	_____
5. We avoid discussing our fears and concerns.	_____	_____	_____	_____
6. We express feelings to each other.	_____	_____	_____	_____
7. There are lots of bad feelings in our family.	_____	_____	_____	_____
8. We feel accepted for what we are.	_____	_____	_____	_____
9. Making decisions is a problem for our family.	_____	_____	_____	_____
10. We are able to make decisions about how to solve problems.	_____	_____	_____	_____
11. We don't get along well together.	_____	_____	_____	_____
12. We confide in each other.	_____	_____	_____	_____

Appendix 7
Socio-Economic Disadvantage

1. Income

What was the total family income from all sources before income tax deductions in *19XX?*

(1) Less than $10,000
(2) $10,000 - $14,999
(3) $15,000 - $19,999
(4) $20,000 - $29,999
(5) $30,000 - $39,999
(6) $40,000 - $49,999
(7) $50,000 - $59,999
(8) $60,000 - $69,999
(9) $70,000 - $79,999
(10) Greater than $80,000

2. Single - parent

Next I'd like to ask you a few questions about you and the family. Are you currently....

(1) A single parent
(2) Or living with a spouse or partner

Appendix 8
Chapter Four
Literature Review Tables

Table 1a
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Design Features

Study:	Isle of Wight Rutter, 1989b; Rutter & Quinton, 1977; Graham & Rutter,1973; Rutter, Tizard & Whitmore, 1970
Sample:	All children attending school on the Isle of Wight who were between 10 and 11 years of age in 1965.
N:	2199
Response Rate:	> 90%?
Assessments:	Age 10/11; Age 14/15
Dependent Variable:	Psychiatric disorder Content - Conduct disorder - Hyperkinetic syndrome - Mixed disorder - Emotional disorder - Child psychosis Method - Stage 1: Parent and teacher questionnaires (Rutter Scales A & B) - Stage 2: Parent and child interviews, psychological testing, teacher questionnaire
Independent Variables:	Maternal psychiatric disorder Marital discord or disruption Low SES Paternal criminality Overcrowding/large family size Admission to care of local authority Reading Problems

Table 1b
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Design Features

Study:	Cambridge Study of Delinquent Development, Farrington, 1990
Sample:	All boys age 8 on registers of six schools within 1 mile radius of study research office in working class area of London (86.9 percent, white & British origin).
N:	411
Response Rate:	> 95 %
Assessments (age):	8, 10, 14, 16, 18, 21, 25, 32

Content

· Boys: Self-reported fighting, delinquency and offending, living circumstances, employment histories, relationships with females, leisure activities
· Parents: Family income, family size, employment histories, child - rearing practices, parent-child separation
· Teacher: Troublesome, aggressive behaviour, attention difficulties, attainments, truancy
· Peers: Daring, honesty, troublesomeness, popularity

Method

· Boys:	8, 10, 14, 16, 18 21, 25, 32 Female psychologists at the boys' school Interview at research office In-home interviews by young, male social science graduates
· Parents	8, 15 Home interviews by female social workers annually
· Teachers	8, 10, 12, 14 Questionnaires
· Peers	8, 10, 12 Questionnaires

Dependent Variable:	Delinquency and Offending
Independent Variables:	Child, parent and family factors as noted above

Table 1c
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Design Features

Study:	Dunedin Multi-disciplinary Health and Development Study 1. Williams, Anderson, McGee & Silva, 1990 2. McGee, Feehan, Williams & Anderson, 1992
Sample:	Birth cohort (1972-1973) of all children born in one hospital in Dunedin, New Zealand.
N:	1037
Response Rate	:> 90 %
Assessment (age):	3, 5, 7, 9, 11, 13, 15
Dependent Variable	Presence of psychiatric disorder: 1. Williams et al., 1990 Content -presence of disorder (conduct or oppositional disorder, attention - deficit disorder, anxiety and depression) at age 11 Method - psyschiatrist administered DISC-C - Rutter Scales A & B - diagnosis by a psychiatrist based on all available information 2. McGee et al., 1992 Content - presence of disorder (attention deficit, conduct disorder, oppositional disorder, depression, anxiety) at age 11 and 15 Method - abbreviated DISC - C - Rutter Scales A and B
Independent Variables:	1. Williams et al., 1990 - Disadvantage, at age 3 (composite of 8 measures) - Low SES at age 9 and 11 - Family Relations Index (7 and 9 years of age) - Marital Status (family structure) - Maternal Depression (at either age 5, 7, 9 or 11 year assessment) - Cognitive Measures (IQ and reading at 7, 9 , 11) - Changes in School (4 or more changes since age 5) - Cumulative Disadvantage (composite of 11 measures on repeated assessments)

Table 1c (Cont'd)
Longitudinal Studies of Aggression and Antisocial Behaviour:
Summary of Design Features

2. McGee et al., 1992
- Family Background
(cumulative disadvantage index used by Williams)
- Academic Competence (reading performance at age 9 and 11)
- Social Competence (age 11)
(10 point index created by author and assessed at age 11)
- Early Behaviour Problems (ages 5 and 7)
(Rutter Scales A and B)

Table 1d
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Design Features

Study:	Dunedin Multi-disciplinary Health and Development Study 1. White, Moffitt, Earls, Robins & Silva, 1990 2. Henry Moffitt, Robins, Earls & Silva,1993
Sample:	Birth cohort (1972-1973) of all children born in one hospital in Dunedin, New Zealand.
N:	1037
Response Rate:	> 90 %
Dependent Variable:	Pervasive Stable Antisocial Behaviour at Age 11/13 (in both studies): - Rutter Scales A & B (age 9, 11); Rutter Scale B at age 13 - DISC-C (age 11) - Revised Behaviour Problem Checklist - parent (age 13) - Self Report Early Delinquency (SRED) (age 13) Antisocial behaviour present if following three conditions met: - clinical diagnosis based on DISC-C and Rutter Scales at age 11 - stable ≥ 85th percentile on antisocial subscale of Rutter Scales at 2 of 3 ages (9, 11, 13) - pervasive: ≥ 85th percentile on antisocial subscale of Rutter Scales for 2 of 5 Raters (child, parent and 3 different teachers)
Independent Variables:	1. White et al., 1990 - health (including measures of developmental delay) at ages 3 and 5 - cognitive (language and draw-a-man at ages 3 and 5) -behavioural (externalizing and internalizing behaviours at ages 3 and 5) 2. Henry et al., 1993 - 29 parent and family variables

Table 1e
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Design Features

Study:	Ontario Child Health Study Follow-up Offord et al., 1992
Sample: N:	Stratified random sample of households in Ontario 1172
Response Rate:	72.5%
Age Range (yrs):	1983: 4-16; 1987: 8-16
Dependent Variables	Content: Conduct Disorder Hyperactivity Disorder Emotional Disorder One or more disorders Method: Ontario Child Health Study Scales - parent, teacher and child (ages 12-16) psychiatric symptom checklist scales
Independent Variables	Age Sex Problems Getting Along Poor School Performance Family Dysfunction Low Income

Table 2a
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Results

Study:	Isle of Wight Rutter, 1989b; Rutter a& Quinton, 1977; Graham & Rutter,1973; Rutter, Tizard & Whitmore, 1970.
Findings:	1. Stability of disorder - 75 percent of children with conduct disorder at age 10/11 had a psychiatric disorder at age 14/15. - 33 percent of children with conduct disorder at age 10/11 had conduct disorder at age 14/15. - 46 percent of children with emotional disorder at age 10/11 had a psychiatric disorder at age 14/15. 2. Family factors - All six variables associated with psychiatric disorder cross-sectionally.

Table 2b
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Results

Study:	Cambridge Study of Delinquent Development, Farrington, 1990
Findings:	Factors present at ages 8 - 11 that predict conviction up to age 32 (based on multiple regression/order of entry of variables) - high troublesomeness at 8 - 10 - convicted parents by 10 - high daring at 8 - 10 - low junior school attainment at 11 - poor housing at 8-10 - separated from parents by age 10

Table 2c
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Results

Study: Dunedin Multidisciplinary Health and Development Study

1. Williams et al., 1990: Factors predicting presence of disorder at age 11 based on logistic regression.

	RO
Male sex	2.48
Maternal depression (chronic & present)	6.55
Marital status (single-parent)	2.18
Reading problems	3.63

2. McGee et al., 1992: Factors predicting presence of disorder at age 11.

	RO	
	Males	Females
Family Background	4.1	4.6
Reading disability	2.9	3.5
Poor social competence	4.2	2.3
History of behaviour problems	6.4	4.7

Factors predicting presence of disorder at age 15, controlling for presence of disorder at age 11.

	RO (males)
Family background	2.1
History of behaviour problems	2.1

Table 2d
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Results

Study: Dunedin Multidisciplinary Health and Development Study
1. White et al., 1990
2. Henry et al., 1993

Findings: 1. White et al, 1990
Five child characteristics at ages 3 and 5 predicted antisocial behaviour at age 11 based on discriminant function analysis:
- externalizing behaviour, age 3
- difficult to manage, age 3
- Rutter Scale (parent) behaviour problems, age 5
- McCarthy Motor Scales, age 5
- Draw-A-Man, age 5

2. Henry et al, 1993
Four parent and family characteristics at ages 3 and 5 predicted antisocial behaviour at age 11 based on regression analysis (controlling for child behaviour at age 5):
- socio-economic status
- mother's reading score
- parent agreement on discipline
- number of parent changes

Table 2e
Longitudinal Studies of Aggression and Antisocial Behaviour: Summary of Results

Study: Ontario Child Health Study
Offord et al., 1992

Findings:

1. Stability of Disorder
- Conduct Disorder present in 1983 and 1987

All	45.0%
Age 4 - 7 in 1983	25.0%
Age 8 - 12 in 1983	60.0%

- One or more disorders in 1987

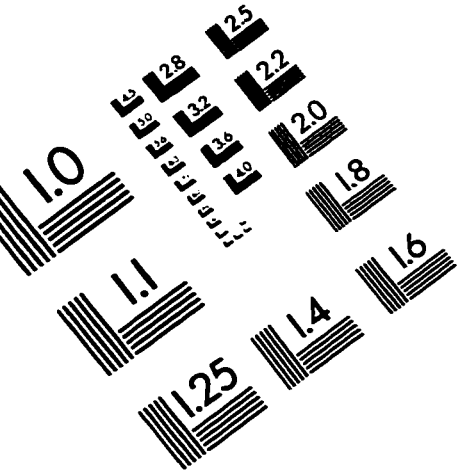
Conduct disorder in 1983	46.1%
Hyperactivity disorder in 1983	40.1%
Emotional disorder in 1983	29.9%

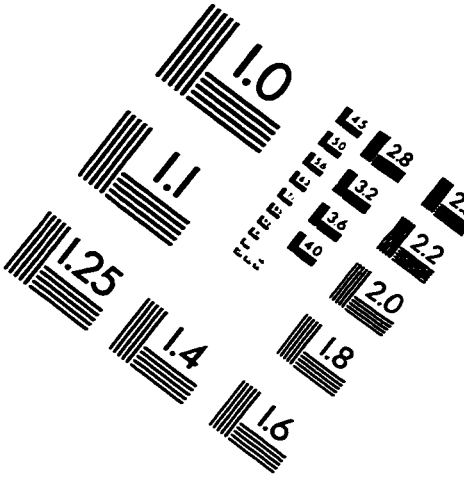
2. Risk Factors*	RO
- low income	2.34

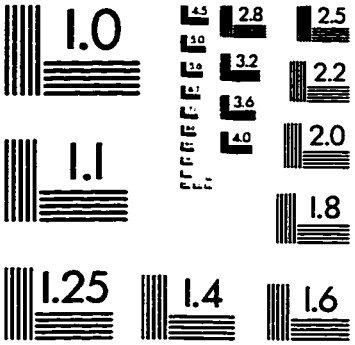
3. Prognostic Factors*	RO
- family dysfunction	4.72
- problems getting along	4.17

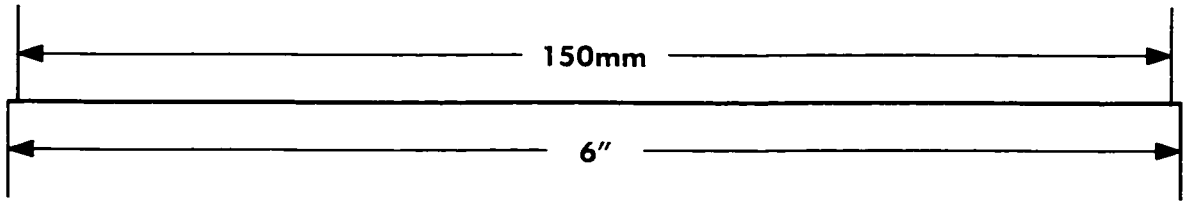
*Derived from logistic regression containing the following variables:
Age 4-7, male sex, family dysfunction, low income, problems getting along, poor school performance and use of mental health or social services (prognostic model only).

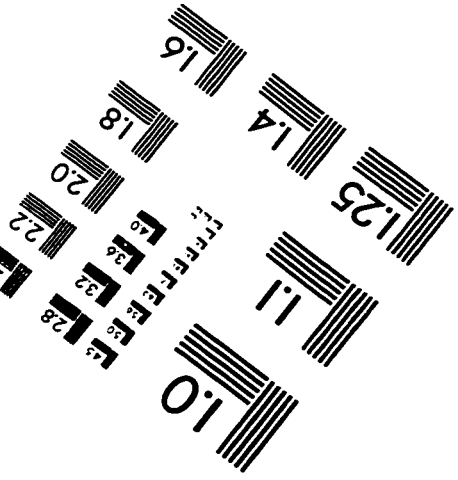
IMAGE EVALUATION
TEST TARGET (QA-3)

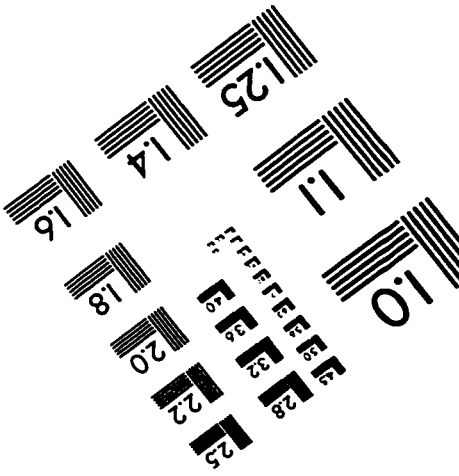












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