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Cumulative Risk Effects for the Development of Behaviour Difficulties in Children and Adolescents with Special Educational Needs and Disabilities

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Running head - **CUMULATIVE RISK EFFECTS FOR BEHAVIOUR DIFFICULTIES**

Abstract

Research has identified multiple risk factors for the development of behaviour difficulties. What have been less explored are the cumulative effects of exposure to multiple risks on behavioural outcomes, with no study specifically investigating these effects within a population of young people with special educational needs and disabilities (SEND). Furthermore, it is unclear whether a threshold or linear risk model better fits the data for this population. The sample included 2660 children and 1628 adolescents with SEND. Risk factors associated with increases in behaviour difficulties over an 18-month period were summed to create a cumulative risk score, with this explanatory variable being added into a multi-level model. A quadratic term was then added to test the threshold model. There was evidence of a cumulative risk effect, suggesting that exposure to higher numbers of risk factors, regardless of their exact nature, resulted in increased behaviour difficulties. The relationship between risk and behaviour difficulties was non-linear, with exposure to increasing risk having a disproportionate and detrimental impact on behaviour difficulties in child and adolescent models. Interventions aimed at reducing behaviour difficulties need to consider the impact of multiple risk variables. Tailoring interventions towards those exposed to large numbers of risks would be advantageous.

Keywords: cumulative risk, behaviour difficulties, special educational needs and disabilities, risk factors.

Cumulative Risk Effects for the Development of Behaviour Difficulties in Children and Adolescents with Special Educational Needs and Disabilities

1.1 Behaviour difficulties and special educational needs and disabilities

Childhood and adolescent behaviour difficulties are often described as externalising behaviours that have disruptive and disturbing effects on others and include verbal and physical abuse, fighting, vandalism, lying and stealing (e.g. Goodman, 2001). These behaviours displayed in childhood and adolescence not only have immediate and profound effects on learning environments and academic achievement (Mcintosh, Flannery, Sugai, Braun, & Cochrane, 2008), but are also associated with a number of more negative outcomes such as unemployment (Healey, Knapp, & Farrington, 2004), perpetration of crime (Fergusson, Horwood, & Ridder, 2005) and increased costs to society (Scott, Knapp, Henderson, & Maughan, 2001).

There is a substantial research base investigating the causes and correlates of childhood and adolescent behaviour difficulties (Brown & Schoon, 2008; Mcintosh et al., 2008; Schonberg & Shaw, 2007). These influences can be called risk factors when the given variable is not only significantly related to the outcome in question (i.e. behaviour difficulties) but also found to precede it temporally (Offord & Kraemer, 2000). For the purpose of the current study a risk factor is defined as "a measurable characteristic in a group of individuals or their situation that predicts negative outcome on a specific outcome criteria" (Wright & Masten, 2005, p.9).

One of the most at-risk groups for behaviour difficulties is young people with special educational needs and disabilities (SEND) (Murray & Greenberg, 2006). The current definition of SEND in England is when a child "has a learning difficulty which calls for special educational provision to be made for him" (Education Act 1996, section 312).

A national study within the UK found that over half of children and adolescents who met the clinical criteria for conduct problems were considered to have SEND by their teacher (Green, McGinnity, Meltzer, Ford, & Goodman, 2005). It is perhaps not surprising that students with SEND are widely considered to be the one of the most vulnerable in the education system (Humphrey, Wigelsworth, Barlow, & Squires, 2013). Despite comprising nearly one fifth of the school population in England, which equates to nearly 1.50 million children (Department for Education, 2014), little research has paid attention to this specific population (for an exception see Oldfield & Humphrey, under review), with no studies to date having assessed the influence of multiple risk factors on behavioural outcomes.

1.2 Cumulative risk

A limitation of some research investigating risk factor for behaviour difficulties is that these variables have often been studied in isolation, whereas in reality they are not independent of one another and frequently cluster together within or around the same individual (Flouri & Kallis, 2007). Young people often experience multiple risks in their backgrounds and across distinct contexts, which impinge on their functioning (Sameroff, Gutman, & Peck, 2003). Focusing on the unique influence of a single factor is unlikely to provide a sufficient explanation of any behaviour displayed, as it is the presence and combination of multiple risks in an individual's background that ultimately result in behaviour difficulties. As every individual experiences a different combination of risk factors, no single factor when present can be said to completely account for these problems (Dodge & Pettit, 2003). Therefore, to further our understanding of risk, and how these factors impact on behavioural outcomes, research needs to consider multiple factors simultaneously.

A number of analytical methodologies have been proposed in the literature in order to assess the effects of multiple risk, (Jones, Forehand, Brody, & Armistead, 2002). One approach is to use a regression analysis where multiple variables are independently added into the model (Gutman, Sameroff, & Cole, 2003). This approach will allow the unique relationships between contextual risks and problem behaviours to be observed and is useful for establishing the specific risk factors that are the strongest predictors of a certain outcome. Nonetheless, these risks in isolation are only able to account for small amounts of variance (Forehand, Biggar, & Kotchick, 1998; Dodge & Pettit, 2003), and there may also be power issues which limit the number of factors that can be included in a model at the same time (Ackerman, Izard, Schoff, Youngstrom, & Kogos, 1999). As this method assumes variables are independent from one another, this neglects the fact that risks are often found to cluster within individuals and are therefore likely to be related in some way (Flouri & Kallis 2007). An alternative method which overcomes some of these limitations has been termed the cumulative risk model.

The basic premise of cumulative risk models (Gerard & Buehler, 2004a) is that assessing risk variables in combination - specifically by summing them to produce a cumulative risk score - will result in a better predictive model than could be achieved if their influences were assessed independently (Appleyard, Egeland, Van Dulmen, & Sroufe, 2005; Evans, Kim, Ting, Tesser, & Shanis, 2007; Forehand et al., 1998). There are two underlying assumptions of cumulative risk models. First, that the total number of risk factors to which an individual is exposed holds a greater influence over development than any specific risk factor or particular combination of risk factors. Number is therefore seen as more important than type or kind of risk (Morales & Guerra, 2006). This idea is rooted in the principle of equifinality (Dodge & Pettit, 2003), which proposes that a negative behavioural outcome does not occur via a

specific route but rather occurs via several distinct pathways. For children with SEND this may results from feelings of incompetence due to problems associated with cognition and learning (Moilanen, Shaw, & Maxwell, 2010), or feeling frustrated at not being able to communicate and interact with others effectively (Hebron & Humphrey, 2014). Thus, as these stressors increase they may well overwhelm any coping mechanisms a child has in place, resulting in disorder and behaviour problems (Flouri & Kallis, 2007).

The second assumption is that those individuals who live in environments where there are more risks for behaviour difficulties are at an increased likelihood of suffering problems than those exposed to fewer risks. That is, the larger the number of risks the greater the prevalence of problem behaviour (Trentacosta et al., 2008). Children with SEND experience a greater number of risks, as having lower economic status (Schonberg & Shaw, 2007), speaking English as an additional language (Brown & Schoon, 2008), and lower academic achievement (McIntosh et al. 2008), are key risk factors for developing behaviour difficulties generally and also salient characteristics of the SEND population (Department for Education, 2014). Multiple risk factors therefore influence behaviour problems by working in a cumulative manner, where exposure to each additional risk factor results in an increase in the problem behaviour, irrespective of the specific risks (Appleyard et al., 2005; Atzaba-Poria Pike, & Deater-Deckard, 2004; Forehand et al., 1998; Lima, Caughy, Nettles, & O'Campo, 2010; Raviv, Taussig, Culhane, & Garrido, 2010).

1.3 Measurement of cumulative risk

Cumulative risk approaches maintain that risk factors can be assessed, then summed together to form a cumulative risk score that is then used as an explanatory variable (Gerard & Buelher, 2004a). These risks are not weighted and each factor has

no greater importance than any other (Flouri & Kallis, 2007). Cumulative indices do not constitute an exhaustive list of risks, and there is no consistently identified set of risks which should be considered the 'gold standard' (Lima et al., 2010).

In order to measure cumulative risk, each potential factor needs to be established as a 'risk variable'. Usually risk variables are defined as such when the correlation between them and the response variable is significant (Lima et al., 2010) or equal to/exceeds .25 (Atzaba-Poria et al., 2004). For binary variables, risk is coded as 1 if present and 0 if absent. On continuous variables scores that are in the lowest/worst-performing 25% of the sample are deemed to be 'risk' and coded as 1, with the remaining 75% of the sample coded as 0. These total scores are then summed for each individual to produce an overall cumulative risk score. As cumulative scores are summed across a number of variables they have the advantage of being both a more stable measure and better able to detect effects, because measurement errors are reduced when scores are added together (Flouri, Tzavidis, & Kallis, 2010).

1.4 The functional form of cumulative risk models

An often neglected and frequently disputed aspect of cumulative risk research focuses on establishing the function of the relationship between risk and behaviour difficulties (Appleyard et al., 2005; Gerard & Buehler, 1999; Jones et al., 2002). Tests can be carried out to find this functional form (Flouri et al., 2010), assessing whether the relationship is linear or non-linear. If a non-linear pattern is observed, investigators seek to establish at what point a 'threshold' may occur. If the relationship between cumulative risk and behaviour difficulties is linear then the proportion of cumulative risk is considered equal to that of the problem behaviour (Appleyard et al., 2005). Cumulative risk researchers have found evidence for these linear effects (Dekovic, 1999; Gerard & Buehler, 1999, 2004a, 2004b; Raviv et al., 2010). A viable alternative

to a linear relationship between cumulative risk exposure and behaviour difficulties is a non-linear relationship (Bierderman et al., 1995; Forehand et al., 1998; Jones et al., 2002; Rutter, 1979). A quadratic type relationship is often discussed in the context of these variables. This relationship suggests that there is a disproportionate increase in problem behaviour displayed as the level of cumulative risk increases. The combined effect of risk on a certain outcome has been termed mass accumulation (Gerard & Buelher, 2004a), signifying that the total effect of cumulative risk exerts an influence on problem behaviour greater than the sum of its parts (Lima et al., 2010; Flouri & Kallis, 2007). This model therefore proposes that risk variables potentiate one another to produce a more serious effect on behaviour.

1.5 The current study

Evidence has demonstrated that risk factors for behaviour difficulties function differently for distinct populations, e.g. based upon gender (Storvoll & Wichstrom, 2002) and socio-economic status (Schonberg & Shaw, 2007). Thus, it is feasible that the risk-outcome relationship, and in particular the role of cumulative risk exposure, is qualitatively different for children and adolescents with SEND than that seen in the general population, A need therefore exists for research to investigate the cumulative effect of behaviour difficulties in this specific population.

The contribution of this study is in developing our understanding of how cumulative risk functions around promoting behaviour difficulties in children and adolescents with SEND. To our knowledge this is the first study of its kind to investigate cumulative risk within a population of children and young people that are widely considered, due to their educational difficulties, to be the most vulnerable in our education system (Humphrey et al., 2013).

The aim of this study was first to investigate the influence of cumulative risk exposure on the development of behavioural difficulties in children and adolescents with SEND, and secondly, establish whether the relationship between cumulative risk exposure and behavioural difficulties in these populations is linear or non-linear.

2. Method

2.1 Design

The current study employed a secondary analysis of longitudinal data from a government-sponsored evaluation of SEND provision in schools in England (Humphrey et al., 2011). Data were analysed in two steps: first by establishing significant risk factors for behaviour difficulties longitudinally within this population (Oldfield & Humphrey, under review); and second by summing these risk factors to form a cumulative score to assess the cumulative risk hypothesis.

2.2 Participants

The study sample included 4288[1] students with SEND (2660 children from 248 primary schools and 1628 adolescents from 57 secondary schools). They were selected from primary schools in Year 1 (aged 5/6) and Year 5 (aged 9/10) and from secondary schools in Year 7 (aged 11/12) and Year 10 (aged 14/15) in order to represent the various phases of compulsory education in England (e.g. Key Stages 1 through 4). In the original study (Humphrey et al., 2011), 10 Local Authorities (LAs – akin to school

[1] The number of participants in the present study was significantly fewer compared with those in Humphrey et al., (2011). Pupils were only included here if they were attending either mainstream primary or secondary schools, and had a complete Wider Outcomes Survey for Teachers (WOST) at Time 1 and Time 2. A detailed missing data analysis was conducted (see Oldfield, 2012) which showed that missing data and attrition did not have a significant effect upon the results.

districts) in England were invited to join the project. The LAs varied in terms of geographical location, population density, and socio-economic factors, and were deemed broadly representative of England (Department for Children Schools & Families, 2009). Senior LA staff then selected schools in their area that reflected local diversity (i.e. attainment and ethnicity).

2.3 Materials

The Wider Outcome Survey for Teachers (WOST) - a teacher report of student behaviour (Wigelsworth, Oldfield & Humphrey, 2013) - was the measurement tool employed to assess the response variable of behaviour difficulties and three explanatory variables (positive relationships, bullying [victimisation], and bullying role). The WOST requires teachers to read statements about a given student (e.g. "The pupil cheats and tells lies") and respond using a four-point Likert scale (e.g. never, rarely, sometimes, often). Item responses are averaged for each domain, ranging from 0-3. The WOST is considered psychometrically robust (Wigelsworth et al., 2013). The remaining explanatory variables in the study were collected from the National Pupil Database (NPD), LAs, and Edubase performance tables[2].

2.4 Procedure

2.4.1 Data generation

Ethical approval for the study was given via the University of Manchester Ethics Committee and informed consent for participation was obtained from parents and

[2] The NPD contains census data for all school-aged children in England and includes socio-demographic and school outcome (e.g. attendance, attainment) data. Edubase is a national school database containing information about all educational establishments in England and Wales (e.g. school size and urban/rural setting).

teachers at the outset of the study. At Time 1 (T1) the WOST was completed for each child by a key teacher (i.e. someone who knew the student well). This survey was repeated 18 months later at Time 2 (T2). During the interim period all additional explanatory variables at school and individual level were collected.

2.4.2 Data analysis

The current study adopted multi-level modelling (MLM) analysis as the data were organised hierarchically with pupils nested within schools. The first step involved establishing the risk factors for behaviour difficulties that would make up the cumulative risk score. All potential risk variables were entered into multi-level models (see Oldfield & Humphrey, under review). From these analyses cumulative risk scores were generated in accordance with studies outlined previously. In keeping with this literature only variable risk factors were used in cumulative risk scores, with demographic fixed variables added as covariates (Flouri & Kallis, 2007). Analyses of data were conducted separately for the primary schools (child model) and secondary schools (adolescent model). First the cumulative risk score was added as a unique explanatory variable (whilst controlling for demographic risk variables) to assess the cumulative risk hypothesis, and second by adding the quadratic term (squared cumulative risk score - Aiken & West, 1991) so that the functional form of the relationship could be assessed.

2.5 Composition of the cumulative risk score

Oldfield & Humphrey (under review) established both individual and school level risk factors for behaviour difficulties in children with SEND. Variables were defined as risk factors when they emerged as significant predictors of behaviour difficulties from either the child or adolescent multi-level models. Here we extend these findings by generating a cumulative risk score for the significant risk factors identified

solely at the individual level. This decision is consistent with previous literature (Atzaba-Poria et al. 2004), where risk accumulation is often measured within a single ecological level. Oldfield and Humphrey found a total of eight significant individual level risk factors in the child model. Four were variable in nature (eligibility for free school meals [FSM]; identified as a bully; having poor relationships with teachers and peers, and lower academic achievement [specifically English attainment]) and led to the cumulative risk score. The remaining four risk factors were demographic (male; autumn born[3]; older within the school system, being identified as having the SEND type - Behaviour Emotional and Social Difficulties) and were added to the MLM as covariates. In the adolescent model seven significant individual level risk factors were noted. Five were variable in nature (eligibility for FSM; identified as a bully; identified a bystander to bullying; poor attendance, poor academic achievement [specifically English attainment]) and made up the cumulative risk score. The remaining two demographic risks (male; younger in the school system) were added as covariates to the MLM.

The variables included in the cumulative risk score have been demonstrated to be key factors in predicting behaviour difficulties in the general population. For example, children growing up in families from lower socio-economic backgrounds are considered to be at a greater risk of developing behaviour difficulties than those living in more affluent homes (Propper & Rigg, 2007); those involved in bullying (as victims or perpetrators) are also at heighted risk for the development of behaviour difficulties (Gini, 2008). Certain influences within a school context can also confer risk for these behaviours, such as poor academic performance (Mcintosh et al., 2008) or poor

[3] In England the academic school year begins in September. Therefore autumn born children (September through November) are the oldest in their school year.

attendance (Miller & Plant, 1999). Finally, young people with more negative relationships with teachers and/or peers are also at heighted risk (Silver, Measelle, Armstrong, & Essex, 2005). The measurement of variables contributing to the cumulative risk score in the current study is shown in Table 1.

<<<INSERT TABLE 1 HERE>>>

3. Results

Results are presented in two phases: first to examine whether increased risk exposure was associated with increased behaviour difficulties; and second to assess the functional form of the relationship between cumulative risk and behaviour difficulties.

Table 2 shows the total number of participants per risk group across the two models. In both models, as the number of risks increased, the numbers of participants in the risk group fell. In both the adolescent and child model less than 1% of participants (n=9 for both samples) were found at the extreme end of the risk scale (i.e. with four risks). As this could potentially skew the findings, these were recoded. Those with four risks were recoded as 3 and the category renamed 3+ risks. This procedure is consistent with previous research (e.g. Gerard & Buehler, 2004a; Appleyard et al., 2005; Raviv et al., 2010).

<<<INSERT TABLE 2 HERE>>>

Multi-level models were then used to establish whether a cumulative effect existed in the data. Behaviour difficulties at T2 was the outcome variable (controlling for T1 behaviour difficulties). The explanatory variables included the cumulative risk

score, and the demographic risk factors were added as covariates. Tables 3 and 4 show these results for the child and adolescent models.

The cumulative risk score was a significant predictor of behaviour difficulties for both the child ($\beta 0ij$ = 0.075, p = <.001) and adolescent ($\beta 0ij$ = 0.124, p = <.001) models. Each additional risk to which a participant was exposed was associated with increases in behaviour difficulties at T2 by 0.075 in the child model and 0.124 in the adolescent model. Results therefore support the cumulative risk hypothesis that the number of risks to which an individual is exposed predicts the development of behaviour difficulties.

The second question investigated the functional form of the relationship between cumulative risk and behaviour difficulties. Table 2 shows the means of behaviour difficulties at T2 for each risk group. As the number of risks increased, the behaviour difficulties score also increased. In order to assess whether increasing cumulative risk has a proportional increase on behaviour difficulties or whether there is evidence of an accelerative effect on behaviour difficulties, further models were computed. The cumulative model (assessing a linear relationship) was assessed against the quadratic model (assessing a non-linear, accelerative relationship) to establish the better fitting model (see Tables 3 and 4).

To test statistically for a non-linear relationship over a linear relationship a squared term of the cumulative risk score was added into the model (Aiken & West, 1991). If the squared cumulative risk score (i.e. a quadratic term) accounts for additional variance beyond the cumulative risk score (i.e. a linear term) and results in a better overall model fit, it can be concluded that a disproportional relationship between risk and behaviour difficulties is present. Due to the issue of multicollinearity however,

it was essential to mean centre the cumulative risk score before squaring it to create the additional variable. This analysis was conducted in two stages. First, the squared term of the cumulative risk score was generated; second, this term was added to the model after accounting for the cumulative risk score and the resulting model was termed a quadratic model (Gerard & Buelher, 2004a).

Results of these analyses are presented in Tables 3 and 4. These tables show the empty model, the cumulative model (with the cumulative risk score) and the quadratic model (which adds in the cumulative risk score squared as an additional explanatory variable). For each model, the behaviour difficulties mean score at T1 is included as a control, along with the significant demographic risk factors as covariates.

In the child model (as seen in Table 3) the better model fit occurred for the quadratic model, as there was a significant reduction in the log likelihood value from the cumulative to quadratic model ($\chi^2(1, n = 2660) = 9.682$ $p < .01$). The squared cumulative risk term in the quadratic model was significant ($\beta 0ij = 0.037$, $p = .002$), even after accounting for the cumulative risk score. In the adolescent model (see Table 4) the better model fit also occurred for the quadratic model, and there was a significant reduction in the log likelihood value from the cumulative to quadratic model ($\chi^2(1, n = 1628) = 3.842$ $p < .05$). The squared cumulative risk term in the quadratic model was significant after accounting for the cumulative risk score ($\beta 0ij = 0.034$, $p = .049$).

These results suggest that a quadratic relationship is a better fit for both the child and adolescent models, accounting for variance beyond the linear terms. Therefore the present study demonstrates there is a disproportionate increase in behaviour difficulties displayed as the level of cumulative risk increases.

<<<INSERT TABLE 3 HERE>>>

<<<INSERT TABLE 4 HERE>>>

4. Discussion

The results for both child and adolescent models demonstrated that cumulative risk exposure was significantly predictive of behaviour difficulties. Specifically, higher risk exposure (regardless of the exact nature of the risk variables) resulted in increased behaviour difficulties. The present study provides support for the cumulative risk hypothesis and previous studies in this area (e.g. Appleyard et al., 2005; Atzaba-Poria et al., 2004; Forehand et al., 1998; Gerard & Buelher, 2004b; Lima et al., 2010; Raviv et al., 2010), extending the evidence base to a new population (children and adolescents identified as having SEND).

Previous research has suggested that problem behaviours result not from single risks but from multiple negative pathways. In the case of the present study, support was found for the assertion that the sheer number of risks to which an individual is exposed may eventually overwhelm any protective factors or coping mechanisms the child or adolescent has in place, and ultimately lead to more severe behaviour problems (Flouri & Kallis 2007).

The functional form of the relationship between cumulative risk and behaviour difficulties was found to be non-linear. This is contrary to the linear pattern observed in a number of previous studies where increments in risk had a similar additive effect on problem behaviour (e.g. Appleyard et al., 2005; Dekovic, 1999; Flouri & Kallis, 2007; Gerard & Buehler, 1999, 2004a, 2004b; Raviv et al., 2010). Within the present study,

however, the quadratic term reached statistical significance for both child and adolescent models, demonstrating that with each increment of risk an acceleration of behaviour difficulties was found. This mass accumulation effect, where the total effect of cumulative risk exerts an influence on behaviour difficulties greater than the sum of its parts (Flouri & Kallis, 2007; Lima et al., 2010), demonstrates that as risk increases beyond a certain level, behaviour difficulties become increasingly severe.

Despite using a distinct population of children and adolescents with SEND and unique risk factors, support is offered towards other researchers within the field who have found the same non-linear relationship with cumulative risk upon various types of problem behaviours (e.g. Bierderman et al., 1995; Forehand et al., 1998; Greenberg, Speltz, DeKlyen, & Jones 2001; Jones et al., 2002; Rutter, 1979). It could be argued that the coping resources young people utilise to counter lower levels of risk may fail once a threshold is reached, and they are unable to overcome the negative influences in their lives, leading to behaviour difficulties. This may be a particularly salient factor for those already disadvantaged by having SEND, as Humphrey et al. (2013) have argued that this group of learners are considered to be particularly vulnerable in the education system.

4.1 Implications

Interventions need to take into consideration the notion of cumulative risk and should be targeted to reduce/ameliorate those to which individual children and adolescents are exposed. The disproportional relationship between increased risk exposure and behaviour difficulties suggests that interventions aimed at those most at risk may be beneficial. Indeed, evidence suggests that higher risk youth will benefit most from interventions designed to reduce aggressive behaviour (Wilson, Lipsey, &

Derzon, 2003) as presumably these individuals will have more to gain than other pupils. Nonetheless, it should be acknowledged that severe levels of risk are experienced by relatively few individuals. Therefore, tailoring interventions towards this group of children and adolescents alone, although beneficial to those directly involved, will make only a small impact on these problems (Flouri, 2008).

The evidence for equifinality and mass accumulation presented here and elsewhere in the literature suggests that addressing multiple risks is perhaps more important than focusing on specific risks, provided that they have been shown to contribute to negative outcomes. For example, in relation to the current study interventions that aim to reduce bullying, increase positive relationships, attendance and academic performance (specifically English), and target the effects of poverty, would be beneficial in reducing behaviour difficulties for children and adolescents with SEND. Furthermore, integrated prevention models – in which multiple risk factors and outcomes are addressed simultaneously in a comprehensive approach that rejects the notion of a 'program for every problem' (Domitrovich et al., 2010) – align very well with this way of thinking and hold particular promise.

4.2 Limitations

The method of data collection for assessing behaviour difficulties was a teacher report. Although this approach could be criticised for lacking accuracy, the justification was that children with the most complex SEND and the younger children within the sample would have had significant difficulty in self-reporting reliably. Furthermore, parental reports are likely to be more biased in their judgments than teacher reports. Teachers are arguably in the best position to consistently reflect on behaviour difficulties displayed of their pupils. They see a wide spectrum of behaviours

difficulties and are therefore able to reliably assess degrees of these behaviours displayed in relation to other children.

In this study risk variables were dichotomised to produce the cumulative score. Although this is a common approach in previous studies, dichotomising variables in this way may lead to oversimplifying the dataset, resulting in information loss (Pollard, Hawkins, & Arthur 1999). Furthermore, cumulative risk scores that use the lowest 25% as a cut-off to signify risk are limited to the sample from which the data were collected and may not reflect the entire population, limiting generalizability (Raviv et al., 2010). Nonetheless, in response to some of these criticisms, Farrington and Loeber (2000) contend that splitting data by means of dichotomisation has a minimal effect on the data and should not affect the conclusions drawn.

A third potential limitation is that the present study did not assess independently the relative importance or power of each individual risk factor. There is some evidence that different risks have varying effects on outcomes (e.g., Ackerman, et al., 1999). Therefore investigating risk accumulation alongside risk specificity would be an appropriate approach which further research could investigate. Nonetheless, this does not undermine the use of a cumulative risk model, which unlike specificity models, is able to account for the natural co-variation of risks and offer more stable measurements. Cumulative models are also found consistently to account for more variance in behavioural outcomes than any single factor (Flouri & Kallis 2007).

4.3 Directions for future research

In the present study, cumulative risk exposure was assessed uniquely at the individual level. Further research should investigate cumulative risk effects across various ecological levels. Deater-Deckard, Dodge, Bates, & Pettit (1998) have

suggested that cumulative scores across multiple ecological levels all contribute to variance in explaining behaviour problems and are important in understanding their aetiology. If a cumulative score was established across multiple ecological levels then an analysis could assess the relative importance of each level (Atzaba-Poria et al., 2004). In addition, testing whether the effects of mass accumulation of risks vary as a function of ecological level (e.g. x risks present within a single level vs. x risks spread across multiple levels) would be a worthwhile pursuit (Morales & Guerra, 2006). As the current study utilised separate models for child and adolescent populations a more in-depth analysis of risk type and function across these populations could be assessed. Finally, assessing the interaction between a child or adolescent's potential coping mechanisms and their level of risk exposure in predicting behaviour difficulties would add value within this area.

4.4 Conclusion

In sum, the current study demonstrated that cumulative risk exposure was significantly predictive of behaviour difficulties in both children and adolescents with SEND. The functional form of the relationship between cumulative risk and behaviour difficulties was found to be non-linear in nature. This contrasts with many studies of the non-SEND population, suggesting that while there may be commonality in terms of the nature of established risk factors, the processes by which these factors exert influence on the development of behaviour difficulties may be qualitatively different.

References

Ackerman, B. P. Izard, C. E., Schoff, K., Youngstrom, E. A., & Kogos, J. (1999). Contextual risk, caregiver emotionality, and problem behaviors of six and seven year old children from economically disadvantaged families. Child Development. 70, 1415-1427.

Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. London: Sage.

Appleyard, K., Egeland, B., van Dulmen, M. H. M., & Sroufe, L. A. (2005). When more is not better: the role of cumulative risk in child behavior outcomes. Journal of Child Psychology & Psychiatry, 46, 235–45.

Atzaba-Poria, N., Pike, A., & Deater-Deckard, K. (2004). Do risk factors for problem behaviour act in a cumulative manner? An examination of ethnic minority and majority children through an ecological perspective. Journal of Child Psychology & Psychiatry, 45, 707–18.

Bierderman, J., Milberger, S., Faraone, S. V., Kiely, K., Guite, J., Mick, E., Ablon, S., Warburton, R., & Reed, E. (1995). Family-environment risk factors for attention deficit hyperactivity disorder: A test of Rutter's indicators of adversity. Archives of General Psychiatry, 52, 464-470.

Brown, M. & Schoon, I. (2008). Child Behaviour. In K. Hansen, E. Jones, H. & Joshi (Eds.), *Millennium Cohort Study Fourth Survey : A user's guide* to initial findings (p165-176). London: Centre for Longitudinal Studies.

Deater-Deckard, K., Dodge, K. A, Bates, J. E., & Pettit, G. S. (1998). Multiple risk factors in the development of externalizing behavior problems: group and individual differences. Development & Psychopathology, 10, 469–93.

Dekovic, M. (1999). Risk and protective factors in the development of problem behavior during adolescence. Journal of Youth & Adolescence, 28, 667–685.

Department for Children Schools and Families (2009). Achievement for All: Local Authority prospectus. Nottingham: DCSF Publications.

Department for Education (2014). Children with special educational needs 2014: An analysis,. London. DfE Publications.

Dodge, K. A., & Pettit, G. S. (2003). A biopsychosocial model of the development of chronic conduct problems in adolescence. Developmental Psychology, 39, 349–371.

Domitrovich, C. E., Bradshaw, C. P., Greenberg, M. T., Embry, D., Poduska, J. M., & Ialongo, N. S. (2010). Integrated models of school-based prevention: logic and theory. Psychology in the Schools, 47, 71-88.

Education Act (1996). London: HMSO.

Evans, G. W., Kim, P., Ting, A. H., Tesher, H. B., & Shannis, D. (2007). Cumulative risk, maternal responsiveness, and allostatic load among young adolescents. Developmental Psychology, 43, 341–51.

Farrington, D. P., & Loeber, R. (2000). Some benefits of dichotomization in psychiatric and criminological research. Criminal Behavior and Mental Health, 10, 100–122.

Fergusson, D. M., Horwood, L.J., Ridder, E. (2005). Show me the child at seven: The consequences of conduct problems in childhood for psychosocial functioning in adulthood. Journal of Child Psychology & Psychiatry, 46, 837-849.

Flouri, E., & Kallis, C. (2007). Adverse life events and psychopathology and prosocial behavior in late adolescence: testing the timing, specificity, accumulation, gradient, and moderation of contextual risk. Journal of the American Academy of Child and Adolescent Psychiatry, 46, 1651–9.

Flouri, E. (2008). Contextual risk and child psychopathology. Child Abuse & Neglect, 32, 913-7.

Flouri, E., Tzavidis, N., & Kallis, C. (2010). Area and family effects on the psychopathology of the Millennium Cohort Study children and their older siblings. Journal of Child Psychology & Psychiatry, 51, 152–61.

Forehand, R., Biggar, H., & Kotchick, B. A. (1998). Cumulative risk across family stressors: short- and long-term effects for adolescents. Journal of Abnormal Child Psychology, 26, 119–28.

Gerard, J. M., & Buehler, C. (1999). Multiple risk factors in the family environment and youth problem behaviors. Family Relations, 61, 343–361.

Gerard, J. M., & Buehler, C. (2004a). Cumulative environmental risk and youth problem behavior. Journal of Marriage & Family, 66, 702–720.

Gerard, J. M., & Buehler, C. (2004b). Cumulative environmental risk and youth maladjustment: the role of youth attributes. Child Development, 75, 1832–1849.

Gini, G. (2008). Associations between bullying behaviour, psychosomatic complaints, and emotional and behavioural problems. Paediatrics & Child Health, 44, 492–497.

Goodman, R. (2001). Psychometric properties of the Strengths and Difficulties Questionnaire (SDQ). Journal of the American Academy of Child & Adolescent Psychiatry, 40, 1337-1345.

Green, H., McGinnity, A., Meltzer, H., Ford, T., & Goodman, R. (2005). Mental health of children and young people in Great Britain (2004). London: Office for national statistics.

Greenberg, M. T., Speltz, M. L., DeKlyen, M., & Jones, K. (2001). Correlates of clinic referral for early conduct problems: variable- and person-oriented approaches. Development & Psychopathology, 13, 255–76.

Gutman, L. M., Sameroff, A. J., & Cole, R. (2003). Academic growth curve trajectories from 1st grade to 12th grade: Effects of multiple social risk factors and preschool child factors. Developmental Psychology, 39, 777–790.

Healey, A., Knapp, M., & Farrington, D. (2004) Adult labour market implications of antisocial behaviour in childhood and adolescence: findings from a UK longitudinal study. Applied Economics, 36, 93-105.

Hebron, J. & Humphrey, N. (2014). Mental health difficulties among young people on the autistic spectrum in mainstream secondary schools: a comparative study. Journal of Research in Special Educational Needs, 14, 22-32.

Humphrey, N., Squires, G., Barlow, A., Bulman, W. F. L., Hebron, J. S., Oldfield, J.,…Kalambouka, A. (2011). Achievement for All National Evaluation: Final report (DfE-RR176). London: DfE.

Humphrey, N, Wigelsworth, M, Barlow, A., & Squires, G. (2013). The role of school and individual differences in the academic attainment of learners with special educational needs and disabilities: a multi-level analysis. International Journal of Inclusive Education, 1, 1–23,

Jones, D. J., Forehand, R., Brody, G., & Armistead, L. (2002). Psychosocial adjustment of African American children in single-mother families: a test of three risk models. Journal of Marriage & Family, 64, 105-115.

Lima, J., Caughy, M., Nettles, S. M., & O'Campo, P. J. (2010). Effects of cumulative risk on behavioral and psychological well-being in first grade: moderation by neighborhood context. Social Science & Medicine, 71, 1447–54.

Mcintosh, K., Flannery, K. B., Sugai, G., Braun, D. H., & Cochrane, K. L. (2008). Relationships between academics and problem behavior in the transition from Middle school to High school. Journal of Positive Behavior Interventions, 10, 243–255.

Miller, P., & Plant, M. (1999). Truancy and perceived school performance: an alcohol and drug study of UK teenagers. Alcohol & Alcoholism, 34, 886–893.

Moilanen, K., Shaw, D. & Maxwell, K. (2010). Developmental cascades: externalizing, internalizing, and academic competence from middle childhood to early adolescence. Development & Psychopathology, 22, 635-653.

Morales, J. R., & Guerra, N. G. (2006). Effects of multiple context and cumulative stress on urban children's adjustment in elementary school. Child Development, 77, 907–23.

Murray, C., & Greenberg, M. T. (2006). Examining the importance of social relationships and social contexts in the lives of children with high-incidence disabilities. The Journal of Special Education, 39, 220–233.

Oldfield, J., & Humphrey, N. (under review). Risk Factors in the Development of Behaviour Difficulties Among Students with Special Educational Needs and Disabilities: A Multi-Level Analysis. Manuscript under review.

Oldfield, J. (2012). Behaviour difficulties in children with special education needs and disabilities: assessing risk, promotive and protective factors at individual and school levels. Unpublished doctoral dissertation, University of Manchester, Manchester, UK.

Offord, D. R., & Kraemer, H. (2000). Risk factors and prevention. Evidenced Based Mental Health, 3, 70-71.

Pollard, J. A., Hawkins, D. & Arthur, M. W., (1999). Risk and protection: are both necessary to understand diverse behavioural outcomes in adolescence? Social Work Research, 23, 145-158.

Propper, C., & Rigg, J. (2007). Socio-economic status and child behaviour: Evidence from a contemporary UK cohort. Centre for Analysis of Social Exclusion (CASE), 125, 1-16.

Raviv, T., Taussig, H. N., Culhane, S. E., & Garrido, E. F. (2010). Cumulative risk exposure and mental health symptoms among maltreated youth placed in out-of-home care. Child Abuse & Neglect, 34, 742–51.

Rutter, M. (1979). Protective factors in children's response to stress and disadvantage. In M. W. Kent & J. E. Rolf (Eds.), Primary prevention of psychopathology: Vol 3, Promoting social competence and coping in children (pp49-74). Hanover, NH: University Press of New England.

Sameroff, A., Gutman, L., & Peck, S. C. (2003). Adaptation among youth facing multiple risks: protective research findings. In S. S. Luthar (Ed). Resilience and Vulnerability. (pp130-155). Cambridge: Cambridge University Press.

Schonberg, M. A, & Shaw, D. S. (2007). Do the predictors of child conduct problems vary by high- and low-levels of socioeconomic and neighborhood risk? Clinical Child & Family Psychology Review, 10, 101–36.

Scott, S., Knapp, M., Henderson, J., & Maughan, B. (2001). Financial cost of social exclusion: follow up study of antisocial children into adulthood. British Medical Journal, 323, 191.

Silver, R. B., Measelle, J. R., Armstrong, J. M., & Essex, M. J. (2005). Trajectories of classroom externalizing behavior : Contributions of child characteristics, family characteristics, and the teacher – child relationship during the school transition. Journal of School Psychology, 43, 39 – 60.

Storvoll, E. E., & Wichstrøm, L. (2002). Do the risk factors associated with conduct problems in adolescents vary according to gender? Journal of Adolescence, 25, 183–202.

Trentacosta, C. J., Hyde, L. W., Shaw, D. S., Dishion, T. J., Gardner, F., & Wilson, M. (2008). The relations among cumulative risk, parenting, and behavior problems during early childhood. Journal of Child Psychology & Psychiatry, 49, 1211–1219.

Wiglesworth, M., Oldfield, J., & Humphrey, N. (2013). Validation of the Wider Outcomes Survey for Teachers (WOST): A measure for assessing the behaviour, relationships and exposure to bullying of children and young people with Special Educational Needs and Disabilities (SEND). Journal of Research in Special Educational Needs, 1, 1-9.

Wilson, S. J.,& Lipsey, M. W., & Derzon, J. H. (2003). The effects of school-based intervention programs on aggressive behavior: A meta-analysis. Journal of Consulting and Clinical Psychology, 71, 136–149.

Wright, M., & Masten, A., (2005). Resilience process in development: fostering positive adaptation in the context of adversity. In S., Goldstein, & S. B., Brooks (Eds.). Handbook of resilience in children (p17-37). New York: Springer.

Table 1. Individual level risk factors used to calculate the cumulative risk score.

Risk Variable	**Description**	**Source**	**Risk present within Childhood or Adolescent model**
Eligible for FSM	Yes or No. FSM eligibility is used as a proxy for socio-economic status and is assessed based on parental income.	NPD	Child and Adolescent model
Academic achievement (English)	Average point scores derived from teacher assessments were converted to Z-scores in each year group, so that an individual pupil's achievement could be compared to average age-related expectations.	Teacher assessment	Child and Adolescent model
Attendance	Proportion of days' attendance at school as a percentage from 0-100.	Local Authority	Adolescent model
Positive relationships	Mean score on positive relationships sub-scale ranging from 0-3, with higher scores indicating better relationships with teachers and pupils.	WOST	Child model
Bully role	Role in bullying incidents as either Bully, Victim, Bully-Victim, Bystander, or Not Involved.	WOST	Bully = Child and Adolescent model Bystander = Adolescent model

Table 2. Number of sample within each risk category and mean (and standard deviation) of behaviour difficulties at T2 for child and adolescent models.

	Child model		**Adolescent model**	
Risks	Number of sample with each risk	Behaviour difficulties M (SD)	Number of sample with each risk	Behaviour difficulties M (SD)
0	1082	0.37 (0.52)	621	0.39 (0.58)
1	968	0.56 (0.65)	606	0.61 (0.71)
2	466	0.82 (0.73)	310	0.89 (0.85)
3/3+	144	1.32 (0.83)	91	1.30 (0.90)

Table 3: Empty, cumulative and quadratic multi-level analyses for the child model

EMPTY MODEL ($\beta 0ij$ = 0.197 (0.019)			CUMULATIVE MODEL $\beta 0ij$ = 0.251 (0.042)				QUADRATIC MODEL $\beta 0ij$ = 0.225 (0.043)			
	Coefficient	**Standard error**	**p value**		**Coefficient**	**Standard Error**	**p value**		**Coefficient**	**Standard error**	**p value**
School Level	0.043	0.006	<.001	School Level	0.040	0.006	<.001	School Level	0.040	0.006	<.001
Individual level	0.237	0.007	<.001	Individual level	0.226	0.007	<.001	Individual level	0.225	0.006	<.001
Behaviour baseline	0.587	0.014	<.001	Behaviour baseline	0.490	0.017	<.001	Behaviour baseline	0.486	0.017	<.001
				Gender[4]	0.075	0.021	<.001	Gender	0.074	0.021	<.001
				Year group[5]	0.088	0.023	<.001	Year group	0.085	0.023	<.001
				Season: Autumn[6]	0.045	0.028	.111	Season: Autumn	0.046	0.028	.097
				SEND type: BESD[7]	0.253	0.032	<.001	SEND type: BESD	0.249	0.031	<.001
				Cumulative risk score	0.075	0.013	<.001	Cumulative risk score	0.054	0.014	<.001
								Cumulative risk score squared	0.037	0.012	.002
-2*log likelihood = 3973.122				-2*log likelihood = 3715.727				2*log likelihood = 3706.045			
χ^2(10, n =2660) = 257.395, p<.001				χ^2(1, n =2660) = 9.682 p < .01							

[4] If male compared with female

[5] If Year 5 compared with year 1

[6] If Autumn born compared with Summer born

[7] If BESD compared with Cognition and Learning

Table 4: Empty, cumulative and quadratic multi-level analyses for adolescent model

EMPTY MODEL ($\beta 0ij$ = 0.197 (0.019)				CUMULATIVE MODEL $\beta 0ij$ = 0.224 (0.039)				QUADRATIC MODEL $\beta 0ij$ = 0.263 (0.040)			
	Coefficient	**Standard error**	**p value**		**Coefficient**	**Standard Error**	**p value**		**Coefficient**	**Standard error**	**p value**
School Level	0.531	0.020	<.001	School Level	0.042	0.012	<.001	School Level	0.042	0.012	<.001
Individual level	0.050	0.014	<.001	Individual level	0.325	0.012	<.001	Individual level	0.324	0.012	<.001
Behaviour baseline	0.336	0.012	<.001	Behaviour baseline	0.042	0.012	<.001	Behaviour baseline	0.476	0.021	<.001
				Gender[8]	0.325	0.012	<.001	Gender	0.099	0.032	.002
				Year group[9]	0.476	0.021	<.001	Year group	0.063	0.030	.035
				Cumulative risk score	0.124	0.032	.002	Cumulative risk score	0.105	0.020	<.001
								Cumulative risk score squared	0.034	0.017	.049
-2*log likelihood = 2926.001				-2*log likelihood = 2864.192				-2*log likelihood = 2860.320			
$\chi^2(3, n=1628) = 61.809, p<.001$				$\chi^2(1, n=1628) = 3.842\ p < .05$							

[8] If male compared with female

[9] If Year 7 compared with Year 10