

Adversity and sex differences in social and emotional sensitivity in children: a possible mechanism for sex differences in psychiatric disorders

Females are superior to males on a range of tasks indexing social sensitivity, the capacity to infer others' mental states and respond with appropriate behaviours and emotions(1-3). There are also sex differences in psychiatric disorders in children and adolescents. Boys have higher rates of psychiatric disorders before puberty, but disorders increase markedly in girls after puberty (4). The causes of the commonest forms of disorder, antisocial behaviour problems in boys, and depression in girls, entail altered brain function caused by genetic variations and psychosocial adversities mainly arising in the family, and the interaction between the two (5;6). This may be explained by sex differences in social and emotional sensitivity provided they can, first, account for male vulnerability to develop antisocial problems in the face of adversity before puberty, second, explain girls' resilience before puberty, and third, account for female vulnerability to depression in the face of adversity after puberty. Associations between reduced social sensitivity and antisocial problems in young children (7;8), and between increased social sensitivity and depressive symptoms in adolescents (9) have previously been demonstrated. However sex differences in the effects of adversity on social and emotional sensitivity have not previously been examined. Here we show that among five year olds, recent adversities (maternal depression and marital discord) are associated with elevated sensitivity in girls but with reduced sensitivity in boys.

In the experimental method for ascertaining social and emotional sensitivity in 5 year olds children are shown doll characters and a dolls' house representing their family and asked to show the experimenter what happens in three different situations. The child is free to portray social processes in the family in whatever way s/he chooses, with only occasional prompts from the experimenter where the

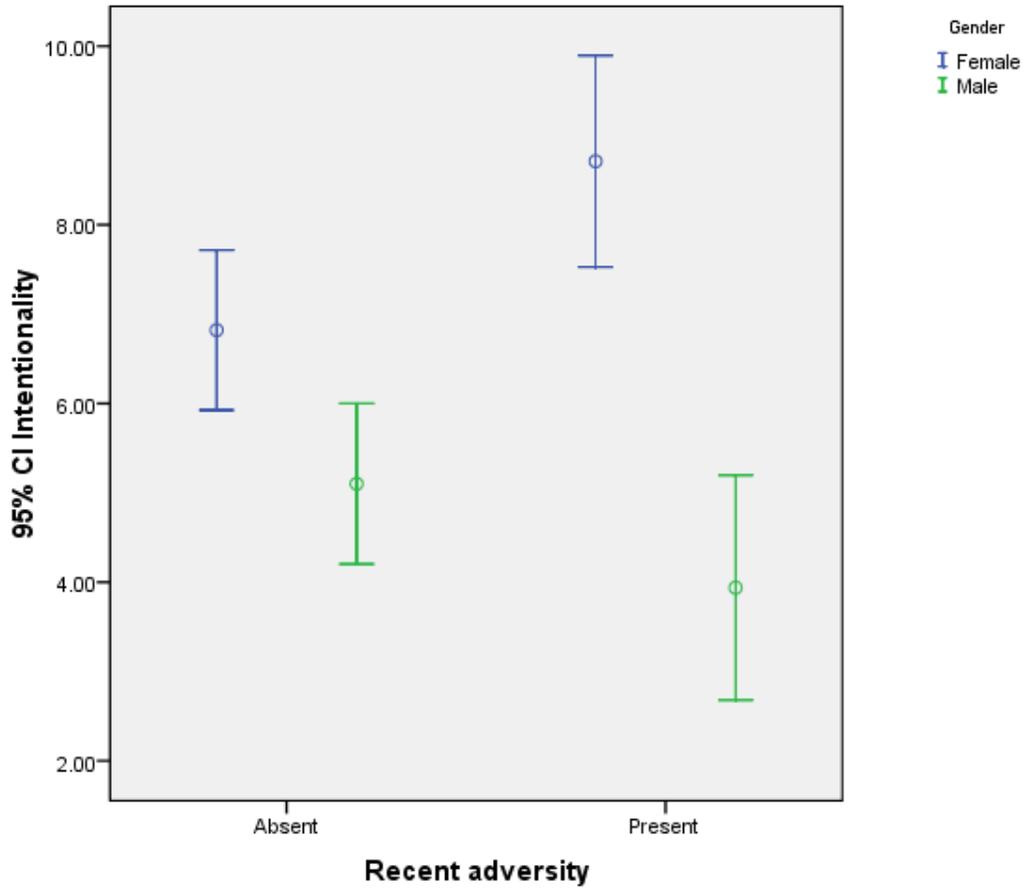
response is brief or difficult to follow. Social and emotional sensitivity shown in the response is assessed on a 12 point scale of 'intentionality'. High scores are assigned for responses that are rich in references to the motives and emotional states of the doll characters, and low scores where these qualities are lacking. Three family situations were presented to the children, 'bed time', 'a bad and nasty time', and 'a happy and best time'. Social and emotional sensitivity was rated in each situation and mean scores computed. Ratings were made by a post-graduate researcher blind to all other information other than the child's gender. The children were recruited during infancy from the general population in a study designed to assess the long term effects of post-natal depression. Previous publications from this study have reported that antisocial problems in boys at age 5 years were associated with low social sensitivity (intentionality) in the doll play assessment (10), and depression in adolescent girls with elevated emotional sensitivity (9). Recent exposure to adversity was assessed in interviews with mothers using standard measures of DSM Major Depressive Episodes and of marital conflict. Recent adversity was considered present either if the mother reported she had been depressed during the previous nine months, or a rating was made of current marital conflict involving the child based on the mother's account. There were 31 children exposed to recent adversity (15 females, 16 males) and 51 unexposed children (28 females, 23 males).

Mean intentionality scores, reflecting social and emotional sensitivity in the doll play responses, were higher in females than males (females 7.48, s.d. 2.40 vs males 4.62, s.d. 2.24, $t = 5.55$, $p < .001$). The comparisons of high and low recent adversity groups in females and males are shown in Figure 1. In ANCOVA controlling for the child's verbal ability, there was a significant gender by recent adversity interaction ($F(1,77) = 8.62$, $p = .004$). Females with recent adversity had higher intentionality scores than those without (adversity 8.71, s.d. 2.14 vs no adversity 6.82, s.d. 2.31, $t = 2.62$, $p = .012$). Males with recent adversity had

lower intentionality scores than those without (adversity 3.93, s.d. 2.36 vs no adversity 5.10, s.d. 2.08, $t = 1.63$, $p = .11$).

The findings provide evidence that the sex difference in social and emotional sensitivity is exaggerated by exposure to adversity in childhood. We propose that the contrasting responses to adversity may explain the differential risk to males and females both in timing and type of psychiatric disorder. Reduced interpersonal sensitivity has several consequences likely to increase antisocial behaviours including poor social problem solving, indifference to others' suffering, and reduced capacity to use empathy to modify aggression (11). Increased interpersonal sensitivity is likely to increase girls' capacities to generate a wider repertoire of strategies for dealing with unpredictable or threatening family environments. However interpersonal sensitivity is associated with accurate emotional responding which may become problematic when there are high levels of threat in the environment, leading to severe and repeated emotional arousal. We hypothesise that in females this combines at puberty with oestrogen related increases in mood disturbances (12) to create vulnerability to depression. Hence the source of resilience for behaviour problems during childhood creates a vulnerability to depression in adolescence.

Figure 1 Mean sensitivity (intentionality) scores in low and high recent adversity groups, comparing males and females



Reference List

- (1) Baron-Cohen S, O'Riordan M, Stone V, Jones R, Plaisted K. Recognition of faux pas by normally developing children and children with Asperger syndrome or high-functioning autism. *J Autism Dev Disord* 1999 Oct; 29(5):407-18.
- (2) McClure EB. A meta-analytic review of sex differences in facial expression processing and their development in infants, children, and adolescents. *Psychol Bull* 2000 May; 126(3):424-53.
- (3) Baron-Cohen S. Autism: the empathizing-systemizing (E-S) theory. *Ann N Y Acad Sci* 2009 Mar; 1156:68-80.
- (4) Ezpeleta L, Keeler G, Erkanli A, Costello EJ, Angold A. Epidemiology of psychiatric disability in childhood and adolescence. *J Child Psychol Psychiatry* 2001 Oct; 42(7):901-14.
- (5) Kim-Cohen J, Caspi A, Taylor A, Williams B, Newcombe R, Craig IW, et al. MAOA, maltreatment, and gene-environment interaction predicting children's mental health: new evidence and a meta-analysis. *Mol Psychiatry* 2006 Oct; 11(10):903-13.
- (6) Polanczyk G, Caspi A, Williams B, Price TS, Danese A, Sugden K, et al. Protective effect of CRHR1 gene variants on the development of adult depression following childhood maltreatment: replication and extension. *Arch Gen Psychiatry* 2009 Sep; 66(9):978-85.
- (7) Gilmour J, Hill B, Place M, Skuse DH. Social communication deficits in conduct disorder: a clinical and community survey. *J Child Psychol Psychiatry* 2004 Jul; 45(5):967-78.
- (8) Hill J, Fonagy P, Lancaster G, Broyden N. Aggression and intentionality in narrative responses to conflict and distress story stems: an investigation of boys with disruptive behaviour problems. *Attach Hum Dev* 2007 Sep; 9(3):223-37.
- (9) Murray L, Halligan SL, Adams G, Patterson P, Goodyer IM. Socioemotional development in adolescents at risk for depression: the role of maternal depression and attachment style. *Dev Psychopathol* 2006; 18(2):489-516.
- (10) Hill J, Murray L, Leidecker V, Sharp H. The dynamics of threat, fear and intentionality in the conduct disorders: longitudinal findings in the children of women with post-natal depression. *Philos Trans R Soc Lond B Biol Sci* 2008 Aug 12; 363(1503):2529-41.
- (11) Hill J. Biological, psychological and social processes in the conduct disorders. *J Child Psychol Psychiatry* 2002 Jan; 43(1):133-64.
- (12) Angold A, Costello EJ, Erkanli A, Worthman CM. Pubertal changes in hormone levels and depression in girls. *Psychol Med* 1999 Sep; 29(5):1043-53.
- (13) Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry* 1987 Jun; 150:782-6.

- (14) Spitzer RL, Endicott J, Robins E. Research diagnostic criteria: rationale and reliability. *Arch Gen Psychiatry* 1978 Jun; 35(6): 773-82.
- (15) Murray L, Fiori-Cowley A, Hooper R, Cooper P. The impact of postnatal depression and associated adversity on early mother-infant interactions and later infant outcome. *Child Dev* 1996 Oct; 67(5): 2512-26.
- (16) Endicott J, Spitzer RL. A diagnostic interview: the schedule for affective disorders and schizophrenia. *Arch Gen Psychiatry* 1978 Jul; 35(7): 837-44.
- (17) Brown GW, Harris T. Social origins of depression: study of psychiatric disorders in women. London: Tavistock; 1978.
- (18) McCarthy D. McCarthy Scales of children's abilities. New York: Psychological Corporation; 1972.
- (19) Murray L, Woolgar M, Briers S, Hipwell A. Childrens' social representations in dolls' house play and theory of mind tasks, and their relation to family adversity and child disturbance. *Social Development* 1999; 8,(2): 179-200.
- (20) Emde RN, Wolf DP, Oppenheim D. *Revealing the Inner Worlds of Young Children. The MacArthur Story Stem Battery and Parent-Child Narratives*. New York: Oxford University Press; 2003.
- (21) Hill J, Hoover D, Taliaferro G. Revised manual for the MacArthur Narrative Completion Task. Topeka, Kansas: Menninger Clinic; 2000.
- (22) Minnis H, Millward R, Sinclair C, Kennedy E, Greig A, Towlson K, et al. The Computerized MacArthur Story Stem Battery--a pilot study of a novel medium for assessing children's representations of relationships. *Int J Methods Psychiatr Res* 2006 Dec; 15(4): 207-14.

Methods

The original sample comprised 100 mother-infant dyads, recruited at approximately 8-weeks postpartum. Initial recruitment was through screening a community sample of 702 primiparous mothers of healthy, full-term infants for PND, by administering the Edinburgh Postnatal Depression Scale (EPDS) (13) at 6-weeks postpartum. Women scoring over 12 on the EPDS were interviewed; 61 women who met Research Diagnostic Criteria (14) for depressive disorder were identified, 58 of whom were recruited for the study. Forty-two non-depressed mothers randomly selected from the same postnatal population were also recruited. All the mothers were white, their mean age was 28 years (SD = 4), 64% were in the upper- to middle-class households (UK Standard Occupation Classification ; classification I, II, or III nonmanual) and 49% had been in full-time education for at least 12 years. Of the original sample of 100 assessed in

infancy, 94 (50 post-natal depression: 44 controls) were assessed at age 5 years and videotaped assessments of the children in a doll play procedure were available for 82 children¹ (15).

Assessments at age 5 years

Recent maternal depression

Mothers were interviewed using the Schedule for Affective Disorders and Schizophrenia, Lifetime Version or SADS – L (16). Episodes of DSM Major Depressive Disorder over the previous nine months were recorded, along with timing of onset and remission.

Chronic difficulties and child involvement in parental discord

The Life Events and Difficulties Schedule (LEDS: 17) was used to assess current chronic difficulties. In addition to the usual LEDS probes, a number were introduced to elicit information about the degree to which the child had been actively exposed to, or was the focus of, any marital conflict, over the past 12 months.

Cognitive Development

The McCarthy Scales of Children's Development were administered (18). These scales have been widely used in research and are a valid and reliable measure of children's cognitive development. The Verbal Subscale was used in analyses presented in this paper.

Dolls' house assessment

The dolls' house procedure has been described in previous publications from this study (19). The child was shown a doll's house that was furnished but had no doll characters in it. The back of the house was removed so that the child's play could be video recorded through the observation window. The researcher explained to the child that they were going to pretend that this was

¹ Technical problems e.g., poor sound quality, meant that tapes could not be rated for 12 children.

the child's own house, asked him/her to choose figures to represent the people in the child's family. The researcher then asked the child to show what happened in the family during four scenes, a Meal Time (warm up), Bed Time, Bad and Nasty Time and Happy and Best Time. The researcher was not directive in the use of the play materials, however standard probes were introduced in order to ensure that the child did respond to the demands of the scene. In the bed time story the questions 'do you go straight to sleep, or does it sometimes take some time' and 'do you wake up in the night sometimes' were always asked. In the bad and nasty time, if the child could not think of one, or said that they never occur, the administrator said, 'let's pretend it is a bad and nasty time', and similarly in the happy and best time. Where the child told a story that was not apparently related to the demands of the scene, the administrator would respond along the lines of, 'is that what happens when it is a (e.g. bad and nasty) time?'

The child's stories were rated using a coding scheme that was developed for use with the MacArthur Story Stem Battery (MSSB; 20;21;22). Some minor modifications were made of the rating rules to take account of the differences between the dolls' house play procedure and the MacArthur Story Stem Battery. A copy of the manual used to rate narratives in this study is available from the first author.

The intentionality scale assesses the extent to which the reasons for the doll participants' behaviours, in terms of mental states, such as needs, desires, feelings, and beliefs, are made explicit or can be readily inferred from the behaviours. This is a 12 point scale in which ratings of 10-12 require that explicit reference is made to the feelings or motives of the participants, whereas ratings in the 7-9 range are made where mental states can be readily inferred but are not referred to explicitly. For example in the 'bad and nasty time' scenario a sequence in which the child says, 'there is a big storm in the night and Michael is frightened and goes into his parent's room for a cuddle' would contribute to a rating in the 10 – 12 range. By contrast, 'there is a big storm in the night and

Michael goes into his parent's room for a cuddle' would contribute to a rating in the 7 – 9 range. Contributions to ratings of 4 - 6 come from portrayed actions whose intentionality refer to physical circumstances of the doll characters, rather than their states of mind or motives. This would be rated, for example if the child said, 'there is a big storm in the night. Michael is mending his bike.' Ratings in the lowest 1-3 range reflect sequences where the dolls are manipulated outside of the rules of their symbolic function. For example, 'there is a big storm in the night, and Michael flies up on to the roof, and then slides down the chimney.' Satisfactory inter-rater reliability was demonstrated between the rater and the first author based on 20 randomly selected assessments (ICC = .78).

Author contributions

LM planned and conducted the study with an award from the Medical Research Council. JH and HS devised the coding system, rated the assessments and analysed the data. All authors made major contributions to preparing the publication.

