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## Infant Behavior and Development



### Long term developmental impact of social withdrawal in infants

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#### ABSTRACT

The aim of this study was to follow-up infants who were assessed in early infancy, at approximately 6 months of age, to determine the developmental impact of social withdrawal at approximately 30 months of age. Infants were administered the Bayley Scales of Infant Development—Third Edition, and the mothers complete the Behavior Assessment System for Children (BASC), Second Edition—Parent Rating Scale—Preschool form. Significant negative correlations were found between infant social withdrawal and Cognitive and Language scales of the Bayley Scales, and the Social and Communication scales of the BASC. Significant positive correlations were found between the infant social withdrawal and later higher scores on Atypicality and Attention scales. These results provide support for the use of the Alarm Distress Baby Scale as a measure of infant social withdrawal, and its association with later development and behavior.

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Spitz and Wolf (1946) in their observations of institutionalized infants noted that the absence of a consistent, nurturing caregiver resulted in an anaclitic depression, with the infants showing muted expressions and social withdrawal. Infant social withdrawal is now recognised as a potentially critical sign that may be the result of numerous causes including: organic conditions (Behrman, Vaughan, & Nelson, 1983); relationship difficulties (Solomon & George, 1999); psychotic and pervasive developmental disorders (Tustin, 1972); and infant depression (Guedeney, 1997) which is now acknowledged as a serious and diagnosable condition of infancy (Zero to Three, 1994). Infant social withdrawal is strongly associated with attachment problems (Rubin & Lollis, 1988) and attachment disorders (Zeanah, Boris, Bakshi, & Lieberman, 2000). The implications of social withdrawal for the infant include an array of development (e.g., language, capacity for symbolic representation, problem solving) and regulatory problems, which are normally achieved through the relationship with the primary care giver (Greenspan, 1992). The interactive disorders, characterized by symptoms of anxiety, behavioral control problems, and sleeping and eating problems (ICDL, 2005), are disorders which result from the child's experience and perception of his or her emotional world, and, or by maladaptive interactional patterns between the caregiver. Therefore social withdrawal in the infant, suggesting problems in the infant's capacity to relate, either as a result of constitutional factors, or relationship problems with the caregiver, leaves the infant vulnerable to a range of interaction disorders.

It is the synchrony of the relationship between mother and child that is an important determiner of infant outcomes. Feldman (2007) discussed synchrony in terms of the parent–infant dyad, as a temporal and organizing feature of the relationship. Synchrony is, according to Feldman, the “co-regulatory lived experience within attachment relationships that provides

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the foundation for the child's later capacity for intimacy, symbol use, empathy, and the ability to read the intentions of others" (p. 330). Both maternal and child factors contribute to synchrony between parent and child, with child withdrawal and maternal depression are associated with failed synchrony and associated developmental psychopathology. As a result of accumulating research, early intervention with infants "at risk" is recognized within the therapeutic community at least, as being essential to prevent the compounding of development problems.

One of the main sources of risk for the infant is depression in the caregiver. It is well documented that there is a relationship between infant maladjustment and maternal depression, possibly resulting from poorer quality of mother–child interaction in the child's first year of life (Milne, Greenway, & Hansen, 2007; Murray, 1992; Pickens & Field, 1993). Tronick and Weinberg (1997) suggested that depressed mothers may have either an intrusive or withdrawn parenting style, which in turn impacts upon the social behavior of the infant resulting in infants of depressed mothers displaying less eye contact, and increased self-comforting behaviors. With modern technology, researchers have been able to demonstrate differences in frontal electrical brain activity between infants of depressed mothers and infants of non-depressed mothers and show that these differences relate to differences in infant behavior, particularly positive social behavior and the expression and regulation of negative affect (Dawson et al., 1999b). Furthermore, it has been found that infants exposed to nonresponsive mothers remain withdrawn even with an emotionally available adult (Dawson et al., 1999a). This research seems to suggest that infants of depressed, nonresponsive mothers themselves become depressed, remaining socially withdrawn.

While a proportion of mothers will report depression or other difficulties, a stigma associated with reporting of mental health problems remains (Byrne, 2001). Moreover, mothers experiencing difficulties with their infants may also not report infant behavior for a variety of reasons, including fear of being judged, or ignorance as to the significance of behavior or lack of recognition of the concerning behavior. It is clearly important to identify infants who are socially withdrawn as early as possible. Ideally this should be done in a setting where babies are routinely assessed such as the maternal and child health centre, thereby not relying upon maternal reports of any difficulties in either the mother or the infant.

Using social withdrawal as an alert to possible infant problems, Guedeny and Fermanian (2001) developed the Alarm Distress Baby Scale (ADBB), designed for use by a trained observer in the context of a routine examination. The advantages of this scale is that it assesses infant social behavior with a stranger, rather than using the caregiver who may feel pressure to perform if asked to interact with her infant during an observation and requires no special equipment (Matthey, Guedeny, Starakis, & Barnett, 2005).

In a recent study of older infants aged 14–18 months (Guedeny, Foucault, Bougen, Larroque, & Mentré, 2008), researchers found infant social withdrawal to be clearly associated with psychological difficulties as reported by parents, and developmental delay. Furthermore it was found that being male; living in foster care or with joint parental custody; being adopted; or being a twin, all to be risk factors for infant social withdrawal. Dollberg, Feldman, Keren, and Guedeny (2006) compared a group of clinic-referred infants with a control group and found that ADBB scores were significantly higher in the clinic-referred group. The mothers of the withdrawn infants were observed to be more intrusive, the infants were less involved in the relationship and there was generally lower reciprocity in the mother–infant relationship. Mothers in the referred group were more depressed, which in turn was associated with poorer relational patterns in both the mother and the child. Gender differences were also noted, with girls being less prone to a withdrawal response. One of the potential limitations of this study was high rate of troubled parent–child relationships that resulted from their clinic's policy to identify high risk families. This meant their findings may not be able to be generalized to a less pathological sample. Results of a recent study by Guedeny and Larroque also suggest that social withdrawal at 12 months of age negatively impacts on language development at 2 years (A. Guedeny, personal communication, December 17, 2007). In a recent study Mäntymaa et al. (2008), of two hundred and sixty infants aged 4, 8 or 18 months and their parents' found infant social withdrawal was associated with maternal higher levels of depressive symptoms as well as with both parents perceived moderate to poor mental health. While paternal depression was not associated with social withdrawal, infants who had both parents reporting symptoms of depression or perceived moderate to poor mental health in the preceding year were more likely to be withdrawn (Mäntymaa et al., 2008).

In a previous community-study of mother–infant dyads who volunteered to participate, we assessed mother–infant dyads on a variety of dimensions including social withdrawal using the ADBB. In the present study we follow up these mother–infant dyads approximately two years later. The purpose of this paper is (1) to explore the longer term developmental impact of infant social withdrawal by demonstrating the relationship between the ADBB results from early infancy with behavioral and cognitive outcomes two years later. We selected the Behavior Assessment System for Children, Second Edition (BASC-2; Reynolds & Kamphaus, 2004) and the Bayley Scales of Infant Development—Third Edition (Bayley-III; Bayley, 2005) as the outcome measures. (2) To explore which factors of ADBB were predictive of later development.

## 1. Method

### 1.1. Participants

The present study is the second phase of an ongoing study of mother–infant dyads from the community looking at the longer term effects of maternal and infant variables on infant development. The original study involved 139 mother–infant dyads. Attempts were made to recontact all of these families. Of the original sample of 139 mother–toddler dyads, 15 did not agree to further participation, and 61 were unable to be contacted. Sixty-two families agreed to participate and 4 were

excluded as the infants had subsequently been diagnosed with medical or developmental disorders that we thought may skew the findings.

Of the 59 infants, 31 were male and 28 were female, and included 1 set of male–male fraternal twins). The mean age of the mothers when they first participated was 30.37 years ( $SD = 4.82$  years), and the mean age of the infants at when initially assessed with the ADBB was 6.56 months ( $SD = 4.12$  months) and at follow up was 31.31 months ( $SD = 4.93$  months). All families came from outer urban Melbourne, an area rated by the Australian Bureau of Statistics as being socio-economically disadvantaged (Baum, Haynes, van Gellecum, & Han, 2005). Most of the mothers (98.5%) were second generation, or more, Australian. Two of the mother's (1.5%) reported being born overseas in south-east Asia, and came to Australia in childhood. Ten of the mothers (77.2%) reported being single, the remaining 129 (92.8%) were living with the father of the infant, either married or de-facto relationship. In terms of levels of education, none of the women reported any post-secondary education, 25 (17.98%) had 12 years of school, 33 (23.74%) had 11 years of school, 72 (51.82%) had 10 years of school, 7 (5.04%) had complete between six and nine years of school, while 2 (1.4%) have complete less than six years of schooling.

The two groups of participants, those who returned for the second study and those who did not return, were compared. There was no significant difference between the two groups on maternal age, infant age, gender of infant, levels of education, or on levels of maternal depression. There was a difference in percentages of high risk children with ADBB scores of 5 or more (in those who participated in the second study (28%) and those who do not participate, (49%,  $p = .011$ ). The two groups were then compared more closely on the ADBB items to see where the differences lay. The only individual item that the two groups showed a significant difference was item 2, eye contact with the infants not participating in the second study showing poorer eye contact than those who did return ( $p = .015$ ). This resulted in a significant difference between the 2 groups on means of ADBB Factor 1 ( $p = .034$ ).

## 1.2. Procedure

Permission to conduct this research was granted by the ACU National and Monash University Human Research Ethics Committees. Mothers who participated in the first study were re-contacted where possible by telephone and post and asked whether they would like to participate in a follow-up study of their infant. The original sample was composed of mother–infant dyads who volunteered to participate in an infant research project through their local Maternal and Child Health Centre, and for whom there were no previous medical, developmental or psychiatric concerns about the mother or the infant. At 6 months of age, mothers and infants were first assessed, and the researcher, a trained infant clinician interacted with the infant for about 10 min and this was video-taped for later scoring by a researcher trained in the scoring of the ADBB. Training was conducted using a series of video clips of infants being undergoing a standard infant check-up. Training continued until the examiner reached reliability ( $r \geq .8$ ) discriminating between infants scoring less than 5 and greater than or equal to 5 on the ADBB, with no repetitive mistake on any item and no more than 2 points variation on the total ADBB score. At follow up, around 30 months, the researchers met those mothers agreeing to participate in their homes. Mothers were interviewed about the development of their infant since they first participated in the study and were asked to complete the BASC-2. The researcher engaged the child in a 10 min period of play and then administered the Cognitive and Language Scales of the Bayley-III. The mothers were re-contacted within a week of the assessment and given feedback on their child's cognitive and language development.

## 1.3. Instruments

The Alarm Distress Baby Scale (ADBB; Guedeney & Fermanian, 2001) is an 8-item assessment tool used to measure social withdrawal in infants. The infant is assessed by a trained clinician during a routine physical examination or clinical setting where the infant is provided with sufficient social stimulation. Each item is rated from 0 to 4, with increasing severity of withdrawal, making a possible total score 0–32. Previous research has found that scores of 5 or more are considered optimal in detecting infant social withdrawal (Guedeney & Fermanian, 2001), using a high risk/low risk score based on a previous epidemiological study in the same area (Choquet, Facy, Laurent, & Davidson, 1982). The score on each item represents the clinicians overall opinion of the infant's performance on each of the particular dimensions. The clinician engages the infant in social behavior by talking, touching, smiling on so on. The 8 items measure: facial expression; eye contact; activity level; self-stimulating gestures; vocalizations; briskness of response to stimulation; relationship with observer; and attraction to the observer. High scores on the ADBB are associated with less optimal interactive behaviors in both mother and infant (Matthey et al., 2005). The scale has been shown to have good reliability and validity (Matthey et al., 2005). Guedeney and Fermanian (2001) found the scale to have 2 factors, one measuring interpersonal dimensions, and other measures non-interpersonal dimensions. Factor 1 consists of 4 items assessing level of eye contact, relationship to observer, facial expression and attractiveness to observer. Factor 2 consists of items measuring response to stimulation, level of activity and vocalizations. Hence Factor 1 targets social capacity of the infant, while Factor 2 targets activity level and vocalizations (Matthey et al., 2005).

Criterion validity of the instrument is considered good with a correlation between nurse and paediatrician ratings of .84 (Guedeney & Fermanian, 2001). The construct validity and the coherence of the items of the scale are supported by a good Cronbach coefficient (Cronbach  $\alpha = .83$ ) for the global scale (Guedeney & Fermanian, 2001).

The Behavior Assessment System for Children, Second Edition—Parent Rating Scale—Preschool (BASC-2, Reynolds & Kamphaus, 2004) provides a multidimensional approach to evaluating dimensions of behavior and personality in children,

**Table 1**

Descriptive statistics of variables used in the analysis and instruments from which they are derived.

Variable	Instrument	Mean (N = 59)	SD
ADBB total	ADBB	3.63	2.86
ADBB F1	ADBB		
ADBB F2	ADBB		
Cognitive	Bayley's-3rd ed.	105.42	11.38
Language	Bayley's-3rd ed.	106.95	13.24
Hyperactivity	BASC-2	49.51	10.00
Aggression	BASC-2	48.12	9.16
Anxiety	BASC-2	49.64	8.59
Depression	BASC-2	45.80	6.68
Somatization	BASC-2	46.27	9.26
Atypicality	BASC-2	52.78	11.53
Withdrawal	BASC-2	47.39	8.92
Attention problems	BASC-2	48.59	7.95
Adaptability	BASC-2	55.22	8.73
Social skills	BASC-2	52.47	8.79
Living skills	BASC-2	48.15	9.62
Communication	BASC-2	47.90	9.49

both positive and negative. There are a number of forms depending on the age of the child, with the 2–3 year old form used for this sample and separate norms for boys and girls were utilized. A parent or carer is required to rate a number of observable behaviors, evidenced during the past 6 months, on a 4 point scale, Never to Almost Always. The BASC-2 has nine clinical scales, including Hyperactivity, Aggression, Conduct Problems, Anxiety, Depression, Somatization, Atypicality, Withdrawal, and Attention Problems, and three adaptive scales including Adaptability, Social Skills, and Leadership. There are also four composite scores including Externalizing Problems, Internalizing Problems, Behavioral Symptoms Index, and Adaptive Skills.

The Bayley Scales of Infant Development—Third Edition (Bayley-III; Bayley, 2005) assesses five key development domains in children: Cognitive, Motor, Language, Social–Emotional, and Adaptive. Assessment of the Cognitive, Language and Motor domains are conducted using items administered to the child; assessment of the Social–Emotional and Adaptive domains are conducted using primary caregiver response to a questionnaire. For the purposes of the current study only the Cognitive and Language domain items were administered to the child. The Cognitive Scale includes items that assess sensorimotor development, exploration and manipulation, object relatedness, concept formation, memory, and other aspects of cognitive processing. The Language Scale is composed of Receptive Communication and Expressive Communication items. The Receptive Communication subtest includes items that assess preverbal behaviors; vocabulary development, such as being able to identify objects and pictures that are referenced; vocabulary related to morphological development, such as pronouns and prepositions; and understanding of morphological markers, such as plurals, tense markings, and possessive's. There are also items that measure children's social referencing and verbal comprehension. The Expressive Communication subtest includes items that assess preverbal communication, such as babbling, gesturing, joint referencing, and turn taking; vocabulary development, such as naming objects, pictures, and attributes (e.g. colour and size); and morpho-syntactic development, such as using two-word utterances, plurals, and verb tense.

#### 1.4. Statistical methods

Quantitative variables are described using mean and standard deviation and categorical variables using percentages. For associations between variables, chisquare or student test, as appropriate, were used. Correlation analyses were used between ADBB, ADBB Factor 1 and Factor 2 with Bayley scores and BASC scales. In order to understand which ADBB factor was contributing more to later cognitive, language and behavioral difficulties, a series of stepwise regression analyses were conducted. In each model, the ADBB Factor 1 and ADBB Factor 2 were entered as the independent variables, and in turn the cognitive, language and Atypicality, Attention Problems, Social Skills, and Communication scales of the BASC were entered individually, as the dependent variable.

## 2. Results

Table 1 shows the descriptive statistics for the variables used in the analysis. It includes the ADBB total scores and ADBB factors as well as the descriptive statistics for each developmental or behavioural scales. The sample showed slightly higher cognitive and language scores than the test's norms. Of the present sample, 16 (27%) were identified around 6 months of age as being 'at risk', with scores of 5 or more on the ADBB.

Table 2 shows correlations between the ADBB and its factors with infant cognitive and behavioral functioning approximately 2 years later. Strong negative correlations were found between the ADBB and the BASC-2 scales: Social, Communication, and with the Cognitive and Language scale of the Bayley's Scales. Significant positive correlations were found between the ADBB and the BASC Atypicality and Attention scales.

**Table 2**

Pearson product–moment correlations of variables used in the analysis.

	ADBB total	ADBB F1	ADBB F2
1. ADBB total			
2. ADBB F1	.891 <sup>a</sup>		
3. ADBB F2	.787 <sup>a</sup>	.550 <sup>a</sup>	
4. Cognitive	–.333 <sup>a</sup>	–.222	–.397 <sup>a</sup>
5. Language	–.397 <sup>a</sup>	–.265 <sup>b</sup>	–.491 <sup>a</sup>
6. Hyperactivity	.187	.081	.067
7. Aggression	.108	.020	.035
8. Anxiety	–.143	–.028	–.149
9. Depression	–.016	–.015	–.085
10. Somatization	–.088	–.106	–.30
11. Atypicality	.343 <sup>a</sup>	.269 <sup>b</sup>	.190
12. Withdrawal	.158	.079	.130
13. Attention problems	.329 <sup>a</sup>	.280 <sup>b</sup>	.200
14. Adaptability	–.110	–.055	–.064
15. Social skills	–.502 <sup>a</sup>	–.353 <sup>a</sup>	–.479 <sup>a</sup>
16. Living skills	–.155	–.034	–.210
17. Communication	–.434 <sup>a</sup>	–.253 <sup>b</sup>	–.481 <sup>a</sup>

<sup>a</sup> Correlation is significant at the 0.01 level (2-tailed).<sup>b</sup> Correlation is significant at the 0.05 level (2-tailed).

A summary of the stepwise regression analyses is presented in Table 3. ADBB Factor 2 was a significant predictor of cognitive outcomes, and accounted for about 16% of the variance of Cognitive scores. Language scores were also predicted by ADBB Factor 2, accounting for 24% of the variance. Similarly, ADBB Factor 2 was a significant predictor of Social and Communication, as reported by the mother, accounting for about 23% of the variance in each. The ADBB Factor 1 was a weaker, yet still significant contributor to both Atypicality and Inattention accounting for 7% and 8% of the variance in each, respectively.

### 3. Discussion

Infant social withdrawal measured with ADBB scale in infancy was associated with poorer cognitive and language development at 2 years measured with the Bayley scales. Withdrawal in infancy was associated with lower social and communicative behavior, and with higher atypicality and inattention scales of the BASC. Finally this study found evidence to suggest that the non-interpersonal components of infant social withdrawal (ADBB Factor 2) were more predictive of cognitive and language ability, and social and communicative skills at 2 years, while the interpersonal components (ADBB Factor 1) of infant social withdrawal predicted and atypicality and inattention at 2 years.

This study provides two important contributions to the literature on infant social withdrawal. Firstly, it documents the longer terms effects of infant social withdrawal. Secondly, it provides data supporting the longer term validity of the ADBB, thus emphasising its importance as an early screening measure. In addition, this study begins to explore more closely the how the two components of social withdrawal in infancy are related to later development problems.

The results clearly demonstrate that withdrawal in early infancy (about six months age), as measured by the ADBB are associated with later behavioral problems and poorer developmental functioning. The results are consistent with the findings of Guedeney and Larroque in an ongoing study with 1000 infants aged 12 months (A. Guedeney, personal communication, December 17, 2007), that show early withdrawals impacts upon language and psychomotor development. While it is too early to claim that infant social withdrawal is the *cause* of these problems, it is clear that withdrawn infants are worse off in the longer term than their non-withdrawn peers. It is likely, based on previous research and the results of the present study that the mechanism for this relationship is to do with the compounding effects of being absent from the interpersonal space, that is so important for early infant development. The study by Mäntymaa et al. (2008), that indicated that when both parents had mental health problems, social withdrawal in the infant is more likely, even though paternal depression did not seem to contribute directly to social withdrawal, may indicate that the father may moderate the effect of maternal

**Table 3**

Summary of final models for step-wise regression analyses for ADBB factors predicting infant variables at 2 years.

Dependent variable	IV included in final model	B	SEB	B	p	R <sup>2</sup>
Cognitive	ADBB F2	–3.785	1.139	–.397	.002	.158
Language	ADBB F2	–5.588	1.303	–.491	<.001	.241
Atypicality	ADBB F1	1.618	.736	.269	.032	.072
Attention	ADBB F1	1.220	.530	.280	.025	.079
Social	ADBB F2	–3.529	.821	–.479	<.001	.230
Communication	ADBB F2	–4.037	.934	–.481	<.001	.231

depression, and suggests that perhaps researchers need to look beyond the mother–infant dyad to examining the broader family system.

Infant social withdrawal is potential indicator of a serious organic or relationship disorders (Guedeney & Fermanian, 2001). Much of infant and child development is dependent upon the relationship with the primary caregiver. Greenspan (2000) for example details six experiences essential to the intellectual and emotional development of the infant and young child, including, in developmental order: self-regulation and attentiveness to the world; becoming securely attached; two-way communication; forming an identity and solving problems, creating ideas; and making links between ideas. All of these occur in the context of a relationship with an attuned caregiver. Hence, social withdrawal poses a considerable developmental risk to the infant.

As one might have predicted, the ADBB seems particularly sensitive to predicting later social and communication problems. Infants who showed signs of withdrawal, later as toddlers tended to be rated as having poorer social skills as measured by the BASC-2 suggesting that they had more difficulty with the interpersonal aspects of social adaptation. Similarly, withdrawn infants, later as toddlers showed poorer functional communication—the ability to express ideas and communicate in a way that others can understand, and poorer formal expressive and receptive language skills, as independently assessed using the Bayley-III. Analysis revealed that the component of infant social withdrawal that was the significant predictor of cognitive and language scores of the Bayley scales, functional communication and social skills of the BASC scales was ADBB Factor 2. This factor is composed of facial expression, vocalisation and response to stimulation (Guedeney & Fermanian, 2001). Facial expression and vocalizations are pre-verbal efforts of the infant to communicate. Similarly the ability to respond to stimulation offered by others is an essential part of early non-verbal communication, as it acknowledges the presences of the other person, and communicates whether one is available or not for interaction, and as such is part of the opening and closing of circles of communication (Greenspan, 1992). These results, therefore suggest that problems with early communication efforts, in the form of responsiveness, vocalizations and facial expression are directly related to later communication skills, social ability and language acquisition. Hence, infant social withdrawal, by definition makes the infant less available for interaction, either because of factors relating to their own capacity to regulate stimulation or factors relating to the carer, such as experiencing their caregiver as emotional unavailability or as frightening (Solomon & George, 1999). Whatever the reason for their withdrawal, it leaves them unavailable for the developmental opportunities afforded by the interpersonal space.

Interestingly, infant social withdrawal was only associated with two types of behavioral problems, as reported by the mother, atypicality and attention problems. Atypicality measures the tendency of the child to behave in odd or peculiar ways, as marked by their disconnection or lack of awareness of their surrounds. High scores on this scale may reflect psychotic or autistic disorders (Reynolds & Kamphaus, 2004). When we examined more closely which of the ADBB factors contributed to atypicality, it was found that ADBB Factor 1, comprising 5 items, eye contact, activity levels, self-stimulating gestures, relationship with the observer and attractivity, was the only significant factor. At least three of these characteristics, eye contact, self-stimulating gestures, and relationship with the observer are in fact very like three of the diagnostic features of autism: marked impairment in use of non-verbal behaviors such as eye contact, lack of spontaneous sharing of enjoyment and stereotyped repetitive motor mannerisms (APA, 2000). Recently, more research attention has been given to early identification of autism, questioning whether or not there are in fact early definitive signs of autism (Gray & Tongue, 2001). However, most of the studies exploring early autistic features use young preschool age children, about 2–3 years of age. The finding of this study suggests that there is potentially some aspect of social withdrawal in early infancy that may point to autistic symptoms. This warrants further exploration.

The Attention Problems scale measures the ability to maintain attention and the tendency to be distracted from tasks requiring attention (Reynolds & Kamphaus, 2004). There is now research evidence to support a link between early attachment disruption, regardless of its causes (e.g., post-natal depression, premature or ill infant etc) and later ADHD symptomatology (Ladnier & Massanari, 2000). Sroufe (1983) proposed that insecurely attached children may learn to over or under regulate their affect and behavior in reaction to caretakers who selectively respond to their emotional needs.

There is now neurobiological evidence demonstrating how the brain adapts to the circumstances the child is in. Children who have experienced attachment-related trauma often show dysregulated behaviors (Balbernie, 2001; Siegel & Hartzell, 2003), consistent with ADHD and learning difficulties. Schore (2001) explained that an infant's early developing right hemisphere is connected to the limbic and autonomic nervous systems, and that it is the role of the primary caregiver to regulate the infant's maturing limbic system and therefore attachment relationship facilitates the expansion of the child's coping capacities. Children with poorer attachment relationships are risk of immature growth and myelination of connections between cortical (control) and limbic (emotion) structures in the infant brain which may result in symptoms of inattention and hyperactivity (Panzer & Viljoen, 2003). In further support of this, higher levels of infant social withdrawal in this study were not only related to attention problems but also to poorer scores on the cognitive scale of the Bayley-III. Hence, it is likely that infant social withdrawal results in inattention and possible learning difficulties in early toddlerhood.

Surprisingly, infant social withdrawal was not correlated with later signs of withdrawal as measured by the BASC-2. The BASC-2 Withdrawal subscale measures the toddler's avoidance of social contact, as reported by the mother. It may be that mothers of infants who were initially withdrawn were unable to identify or report symptoms of withdrawal in their toddler. It is possible that the BASC-2 Withdrawal scale picks up "shyness" as identified by the mother. Withdrawal is obviously not an isolated construct nor is it a temperamental disposition which is relatively stable across time. Indeed, Matthey et al. (2005) distinguished between infant social withdrawal and temperament saying that temperament refers to the infant's

responsiveness to a variety of stimuli, not only social stimuli, and that a temperamentally shy infant is still responsive to an available adult. A withdrawal response in infancy is problematic therefore, not because it leads to later withdrawal per se, but because of the compounding effects on development of not being present in the interpersonal space—the space upon which much of infant development depends.

There are several limitations of the study. Firstly, only about half of the original sample was available for follow-up. Those that did not return showed higher levels of social withdrawal at 6 months and poorer eye contact. Based on the trends in these results, we would predict that the non-returned infants would have fared more poorly in follow-up, resulting from the compounding effects of social withdrawal, and therefore if had they been included in the present results, we would expect stronger associations. Secondly, this study was conducted on a community sample and the results cannot necessarily be generalised to a clinical population. Thirdly, when we identified infants as being “at risk” with the ADBB scale at around 6 months of age, mothers were referred for clinical intervention. We have no information about which infants received therapeutic interventions. The strength of associations in our results may have been diluted if the mother–infant dyad did receive an intervention of some sort.

The results of this study provide support for the use of the ADBB as a measure of infant social withdrawal that in turn results in cognitive and social difficulties two years later, and provides some predictive validity of the scale. Hence the results highlight the importance of early screening for infant social withdrawal and specifically the use of the ADBB. Further research on the underlying structure of the ADBB is needed. It is possible that social withdrawal symptoms vary with age, so that a symptom at 6 months has a different meaning to the same symptom at 18 months. Hence, the results support the use of the ADBB as an important screening tool in infancy.

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