UNIVERISTY OF CALIFORNIA

Santa Barbara

Mediational Effect of Maternal Depressive Symptoms on the Relationship between Social Support and High Risk Child Health Outcomes

A Thesis submitted in partial satisfaction of the

requirements for the degree Master of Arts in

Psychological and Brain Sciences

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December 2016

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September 2016

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ACKNOWLEDGEMENTS

I would like to acknowledge both of my academic advisors, Aaron Blackwell and Daphne Bugental. You have both been incredibly supportive over the years and I cannot thank you enough for that. I would also like to thank Angela Garcia. You were the best lab-sister a girl could have! I know cannot thank everyone who deserves it here, but I will give it a shot. In no particular order, thank you to: Nancy Collins, Jim Roney, Randy Corpuz, Anne Pisor, Adrian Jaeggi, Diane Mackie, Leda Cosmides, Michael Barlev, Michelle Kline, Matt Gervais, Montserrat Soler, as well as Anusha Pusuluri, Ekta Prashnani, and Rose Elfman, my best friends in California. A special thanks goes to Jessica Pommy; you are my platonic soul mate and you have kept me going through so much, I wouldn't be here without you.

All of you have helped me to both endure and grow during my time at UCSB and I am immeasurably grateful.

ABSTRACT

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Previous research has indicated that various forms of parental resources (money, attention) affect parental investment in children, contingent on the health risk of the child (Beaulieu & Bugental, 2008; Bugental & Schwartz, 2009; Bugental, Beaulieu, & Silbert-Geiger, 2010). In other words, high resource parents with a high risk child invest more in their child than high resource parents with a low risk child. A reverse pattern holds for low resource parents. This study examines social support as another parental resource with a downstream effect on an outcome of successful parental investment: child health. Social support has been shown to ameliorate maternal depression (Cutrona & Troutman, 1986), which in turn is predictive of premature infants' cortisol reactivity (Bugental, Beaulieu, & Schwartz, 2008). Depressive symptoms also serve as signals for assistance (Hagen, 2002), which is particularly important for mothers of high risk children. We tested the hypothesis that social support would positively affect child health by reducing maternal depressive symptoms. Our predictions were supported. The relationship between social integration and child health was mediated by maternal

depressive symptoms for high risk children, but not for low risk children providing support for the contingent parental investment model.

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Introduction

There is a basic conflict of interest between parents and their children. Children would do best to extract as much investment from their parents as possible. However, parents possess only finite resources (such as time, money, and energy) and resources invested in one child cannot be invested in another child (Trivers, 1974). Thus, in order to achieve their own greatest lifetime reproductive success, parents should allocate their resources selectively amongst their children according to individual need and the effectiveness of this investment (in terms of child health and survival).

Expanding on this theory, Daly and Wilson (1988a) predicted and demonstrated that mothers allocate their resources amongst their children based both on the given child's characteristics and their own level of resources. Parents are more likely to invest in low risk (i.e., high reproductive value) children, who have the best chance of surviving to adulthood and successfully reproducing, thus increasing their parents' reproductive success. Daly and Wilson also proposed that the distribution of parental investment should be sensitive to environmental conditions and parents' own levels of resources. As a result, parents should invest less in their offspring when circumstances are harsh and they have poor access to resources like money or social support. Daly and Wilson posed these two factors (child reproductive value and parental resources) as having direct linear relationships with investment outcomes, but only later work has examined the contingent effect of their interaction on investment patterns.

Contingent Parental Investment Model

The contingent model is based on pilot work by Mann (1992) and Bereczkei (2001). This model predicts that parental investment outcomes result from an interaction between child

reproductive value (indexed by prematurity, health, visible deformity) and parental resources, both somatic and external (socioeconomic status, physical and mental health status, social support). As such, high resource parents are expected to invest more in a high risk child than they would in a normal child, and low resource parents should invest more in a normal, low risk child than in a high risk child.

Mann (1992) addressed a component of this model by examining mothers' investment in low birth weight twins according to each infant's respective health (i.e., risk status). There are two choices a mother can make when faced with a high risk infant: (1) she can increase her investment to meet her child's needs in the possibility that this will improve the child's reproductive value, or (2) she can reduce her investment, a less costly strategy that frees up her resources to allocate to other children who may be a 'better bet'. Mann found that mothers tended to show a behavioral preference toward the healthier twin, consistently directing more positive maternal behaviors to the healthier of the pair. Bereczkei (2001) found a similar effect of infant health on breastfeeding, with lower birth weight infants being suckled significantly less time than higher birth weight infants. In addition, mothers with relatively more resources, indexed by more education, tended to suckle their infants longer.

Davis and Todd (1999) demonstrated a similar pattern of contingent investment in a computer simulation study on birds, animals that simultaneously care for several young varying in size and strength. The simulation took into account reproductive value (indexed by chick size and varied between chicks in the same brood) and parental resources (indexed by the mean food availability in the environment). Parental reproductive success was assessed by the total weight of the surviving chicks. In poor environments, mothers were most successful feeding the largest chick first, in a sense taking the 'safe bet' by caring most for the healthiest chick. In abundant

environments, mothers did best by feeding the smallest (neediest) chick first because they had access to enough resources to adequately support their other chicks regardless of the cost of the neediest chick.

The contingent parental investment model was fully formalized by Bugental and colleagues (Bugental & Beaulieu, 2003). The model assumes the basic trade-off specified by Trivers (1974) in which any investment (of time or material resources) in a given child leaves parents with less to invest in any other child; a zero-sum situation. Bugental and Beaulieu (2003) argued that mothers with high resource access can 'afford' to provide increased care to high risk offspring without endangering the outcomes of their low risk offspring, as was found in Davis and Todd's (1999) simulation. A unique prediction from this model is that high risk offspring with high resource mothers will experience an advantage.

Buttressing support for the contingent model is found in contrasting accounts between third world poverty environments and financially advantaged environments. Scheper-Hughes' (1985) ethnographic account of poverty-stricken mothers living in Brazilian shantytowns described preferential distribution of scarce resources to the children most likely to survive in that harsh environment. Infants found to be more vigorous and healthy were more likely to be fed than infants who seemed weaker. An opposing pattern was found by Field (1982), in which middle-class mothers in financially advantaged countries reacted to the high risk status of their preterm infants with increased investment. A similar increased investment effect has also been found in other primates such as macaques; some infant macaques with limb malformations received extensive and specialized care from their mothers, more than other infants with no malformations (Nakamichi, 1986).

Bugental and colleagues have conducted multiple empirical tests of the formal contingent model making use of both experimentally varied and naturally-occurring differences in maternal resources, and focusing on preterm children.

In empirical tests of the contingent model, two types of parental resources were measured: (1) mothers' participation in an intervention program that improved problem solving skills in a caregiving context and increased feelings of empowerment (Bugental, et al., 2002), and (2) mothers' depressive symptoms as an indicator of reduced attention or emotional resources (Beaulieu & Bugental, 2008).

Parental investment was measured in several ways. This included an assessment of (1) mothers' willingness to spend time and effort to obtain information about their child (Bugental & Beaulieu, 2006), (2) the proportion of time mothers spent with the child rather than with others (Bugental, Beaulieu & Silbert Geiger, 2010), (3) the proportion of the family budget mothers spent on the child (Bugental, et al., 2010), and (4) mothers' preference for obtaining benefits for the child as opposed to themselves (Beaulieu & Bugental, 2008).

In the context of the intervention (Bugental et al., 2002), families were randomly assigned to a traditional home visitation (HV) condition that provided parental support and education, a cognitively enhanced home visitation (HV+) condition that focused on problem solving strategies and cognitive reappraisal training, or a control condition in which no services were provided. A target child who was either high (preterm) or low risk (full term) was chosen in each family. In the first study, after the conclusion of the program parents were invited back for a lab visit to learn more about their child's age related progress; a major expenditure of time and effort due to the distance of the lab from their homes. Consistent with the contingent model,

mothers with relatively high resources (HV+) with preterm children were most likely to seek out this information, and lower resource (HV) mothers with preterm children were least likely to do so (Bugental & Beaulieu, 2006). In a second study (Bugental, Beaulieu & Silbert-Geiger, 2010) using the same intervention, a similar pattern was found. Mothers in the HV+ condition tended to preferentially invest time and money (proportion of family budget) in high risk children and mothers in the HV condition preferentially invested time and money in low risk children and less in high risk children. Levels of maternal investment in turn predicted health outcomes for high risk children, who fared as well as low risk children when the mother had relatively greater resources (HV+) but suffered poorer health when their mothers had relatively fewer resources (HV).

In a third study, maternal depressive symptoms were used to indicate the level of attentional or emotional resources mothers had available to invest in their children and mothers were asked to complete a measure that assessed mothers' willingness to provide material benefits to their child as opposed to themselves (Beaulieu & Bugental, 2008). Child risk was again based on the child's pre- vs. full term status. Consistent with predictions, depressed mothers tended to preferentially invest in themselves relative to their preterm child but not relative to their full term child. The reverse pattern was found in non-depressed mothers; they preferentially invested in themselves relative to their full term child, but preferentially invested in their preterm child.

Child Reproductive Value

Child condition is an important consideration in calibrating parents' investment strategies (Daly & Wilson, 1984, 1980, 1987, 1988a, 1988b) and reproductive value is the most evolutionarily relevant index of child condition (Daly & Wilson, 1988a; Hill, 1993; Mann,

1992). Reproductive value is conceptualized as the likelihood an individual will survive to adulthood and reproduce. This definition takes into account both child health cues, such as general vigor, disease, and age, as well as visible physical malformations, which impact attractiveness and can reduce later mating opportunities.

There is evidence for this selective allocation of resources based on infants' displays of vigor, such as strong cries and behavioral responsiveness (children who are less responsive tend to be less well liked and more harshly disciplined). Sheper-Hughes' (1985) study of a Brazilian shanty town revealed selective maternal neglect of infants who mothers perceived as not vigorous enough or too 'dull' and unresponsive for her to have confidence in their survival (regardless of her own intervention). This neglect was based on a folk belief that some children are meant to die, most likely a cognitive strategy to reconcile mothers to the loss of many children to disease and starvation. As a result, mothers would stop provisioning those infants and instead preferentially invest in their other, stronger-seeming children.

Age is also a crucial factor in reproductive value (Daly & Wilson, 1988a, 1988b; Hill, 1993). Older children have already passed a milestone by surviving infancy, which is the period of life with highest extrinsic mortality. Thus, older children are significantly more likely to survive to adulthood than infants are, and are a safer bet for a parent to invest in. Consistent with this, there is evidence that children are at the highest risk of death from parental neglect/abuse as infants (Daly and Wilson, 1988a, 1988b). Older children also require less intensive care than infants thus easing the burden of parenting in some respects.

Visible physical anomalies also tend to elicit less investment from parents. Weiss (1998) found that infants with visible malformations are sometimes abandoned by their parents, who

refuse to take an 'ugly' child home with them. However, infants with non-visible physical anomalies, such as heart malformations, are not abandoned as often. In our evolutionary past, preterm children embodied lower reproductive value because of their greater risk of morbidity and mortality than full term infants. Despite the reduced health risk in modern industrialized countries, preterm infants still exhibit visible markers of risk such as less 'babyish' features which many adults perceive as less attractive (Maier, Holmes, Slaymaker & Reich, 1984). Maier and colleagues (1984) have also found that individuals rated preterm infants as less fun, more difficult to care for, more irritable and less predictable—based only on viewing a photograph of the infant.

Parental Resources

Parents' emotional, physical and economic condition also affects how likely they are to invest and how much they invest in a particular child (Daly & Wilson, 1984). Parental investment decisions are closely tied to access to resources like, food, time, money, and social support. There is an explicit association between resource scarcity/stress and reduced investment in risky offspring (Scheper-Hughes, 1985; Davis & Todd, 1999; Daly & Wilson, 1988a).

Types of Parental Resources

Even in modern western societies parents who face financial hardship tend to reduce investment in their children, with some parents manifesting abuse and neglect (Garbarino, 1985). Teenage mothers, who are mostly unmarried and thus do not have reliable access to the social or financial support of a mate, are at higher risk of fatally abusing or neglecting their children (Daly & Wilson, 1988a). In ethnographic accounts the birth of twins or the presence of too many

dependent children can prompt complete disinvestment by infanticide (Daly & Wilson, 1988a) due to resource stress on the parents. In the realm of psychological resources, it has been shown that impoverished attentional resources and enhanced problem solving skills can affect levels of maternal investment (Bugental, Beaulieu, & Silbert-Geiger, 2010).

Social support is another valuable resource that has been an integral part of human evolution (Kaplan, Hill, Lancaster, & Hurtado, 2000) and has a significant impact on child health and survivorship (Sear & Mace, 2008). The importance of social support in parenting is evident even in lower primates. Monkey mothers who are housed individually with their infant or otherwise isolated from other monkeys are more likely to neglect or abuse their infants, and this effect is ameliorated by placing mothers in spacious group living situations (Hinde & Spencer-Booth, 1967). In humans, there is evidence that the deterioration of social support systems with the advent of the modern urban environment is related to an archeologically detectable increase in child physical abuse (Walker, 2001). In modern populations, the support of one's natal kin has the potential to reduce domestic violence (which often has a side effect of child abuse; Figueredo & McCloskey, 1993) and is related to a decrease in anxiety and depression for both sexes, higher levels of which are often antecedent to spousal abuse (Figueredo et al., 2001). Social support is also related to more positive maternal mood states and higher satisfaction with the child, affecting subsequent infant development (Affleck, Tennen & Gernshman, 1985).

Manifestations of Parental Investment

Parental investment can manifest in many different ways. In modern societies, money is a major means of investing in one's child, spent not only on essentials but also on relative luxuries. Parents spend a great deal of time and money finding housing they deem adequate for

their families in safe neighborhoods with good schools. Money is saved for college and spent on toys and activities such as videogames and sports. Parents spend copious amounts of time in direct care of their children, playing with and teaching them skills as well as supervising. All of these activities require a large degree of parental attention, a resource that can be greatly restricted by psychiatric conditions such as depression.

Maternal depression is often accompanied by unintentional emotional or attentional withdrawal. The mechanism of this disinvestment may have a neurophysiological basis. Depressed mothers tend to show no difference in neural response to hearing the distress cries of their own infant when compared to a control sound, whereas non-depressed mothers show increased activation (Laurent & Ablow, 2011). This group level distinction held irrespective of current symptomatology, indicating this lack of increased neural activation is a stable marker of maternal depression. This subtle lowering of attentional investment is associated with higher baseline cortisol in infants, carrying a risk of causing permanent maladaptive changes to physiological stress response systems (Bugental, Martorell & Barrazza, 2003). These changes are in turn associated with cognitive deficits, social-emotional problems and sensitization to later stress. Preterm infants are especially sensitive to the emotional climate in their home, manifesting higher cortisol levels than full term infants when their mothers are depressed (Bugental, Beaulieu & Schwartz, 2008; Affleck, Tennen & Gernshman, 1985)

In Bugental et al.'s (2002) intervention study, it was found that maternal depression mediated the relationship between intervention condition (described above; HV, HV+, and control) and child health outcomes. Condition predicted depressive symptoms, and depression predicted child health, such that the incrementally enhanced (HV+ > HV > control) condition predicted better health partially through reducing depressive symptoms. The intervention

involved training mothers how to acquire resources - both tangible and social. This has clear significance for increasing parental investment through both enhancing mothers' ability to provide material support and by ameliorating depressive symptoms, thus increasing maternal attentional availability. Ostensibly, mothers' feelings of helplessness/hopelessness were reduced by simultaneously increasing their sense of self sufficiency as well as providing them with methods for garnering assistance from others.

Depressive symptoms show a consistent relationship with social support. Social support reduces maternal tendencies to experience caregiving events as stressful (Cutrona, 1984) and buffers against maternal depression when dealing with infants with difficult temperaments (Cutrona & Troutman, 1986). The quality of familial relationships, such as with the mother's own mother, are also known to affect post partum depression, increasing depression with decreasing quality of relationship (Douglas, 1963; Kumar & Robson, 1984; Richman, et al., 1991). Spousal support shows a similar pattern (Richman, et al., 1991; Buchwald & Unterman, 1982; Unterman, et al., 1990). Poehlmann and colleagues (2009) found that within individuals, family support consistently and negatively covaried with depressive symptoms over time. Mothers of low birth weight or preterm infants are especially in need of social support, due to the atypical level of stress from this event (Davis, Edwards, Mohay & Wollin 2003).

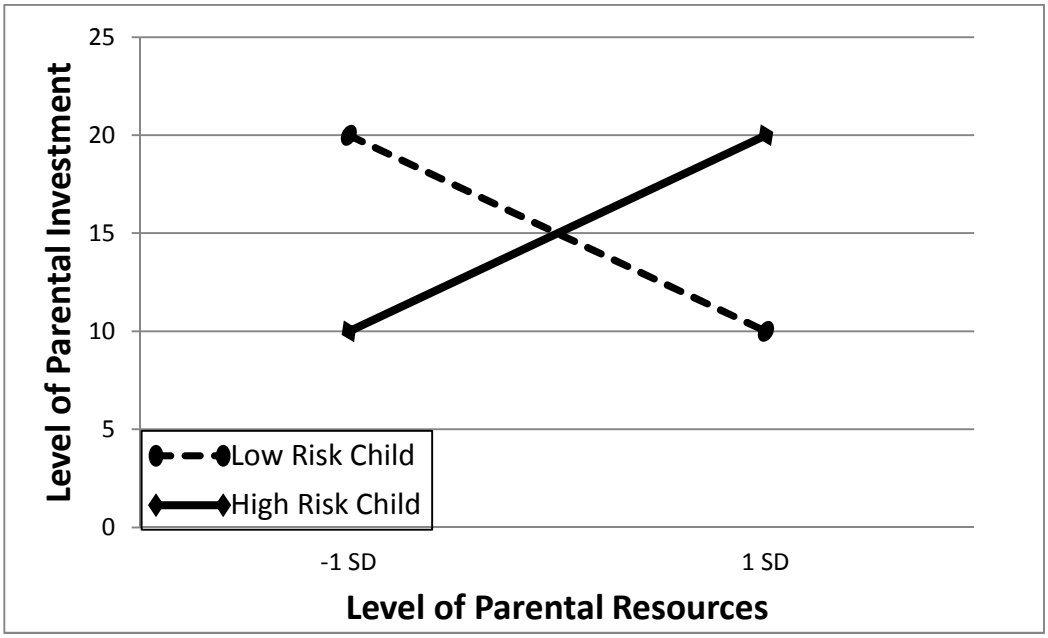
An evolutionary approach to explaining depressive symptoms, in women, yields two dominant hypotheses; post partum depression serves as a response to birthing a low quality infant and provides motivation to the mother to disinvest in the infant (Thornhill & Furlow, 1998), or as an unconscious means of securing more social support from one's social and kin network through the 'threat' of disinvestment in the infant (Hagen, 2002). Both evolutionary

explanations may be true and yield overlapping hypotheses; social support should relate positively to parental investment by decreasing depressive symptoms.

Current Study

Mothers' parental investment was predicted to be affected by both the availability of relevant resources, specifically social support, and child risk status (as determined primarily by gestational age). This interaction was expected to yield a contingent pattern wherein high resource mothers invest relatively more in a high risk infant than in a low risk infant, and low resource mothers invest relatively more in a low risk infant than in a high risk child. See Figure 1 for an illustration of the predicted model.

Figure 1. Contingent model of parental investment

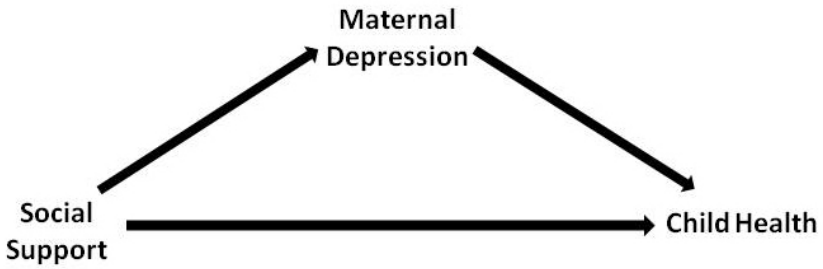


We also measured the role of parental investment as a mediator of the effects of social support on child health. The first mediator tested was the amount of time mothers invested in the welfare of the child (relative to time invested in welfare of self or others). As noted earlier,

maternal time investment was found to mediate the relation between the interaction between maternal cognitive resources, and health at older ages among high risk children (Bugental, Beaulieu & Silbert-Geiger, 2010).

The second mediator tested was maternal depression, an implicit measure of maternal investment as it is predictive of attentional and emotional withdrawal on the part of the mother. This second mediating relationship will be especially relevant to the outcomes of high risk infants, who are more hormonally sensitive to maternal depressive behaviors (Bugental, Beaulieu and Schwartz, 2008). Past research has only demonstrated the mediating effects of parental investment on child health for at risk children (Bugental, et al., 2010). Therefore, we only have a secure basis for predicting a mediating role for parental investment on child health among high risk children. See figure 2 for an illustration of this prediction.

Figure 2. Hypothesized mediation of the relationship between maternal social support and child health outcomes by maternal depressive symptoms.



Mothers recruited from the general community were measured for the amount and type of their current levels of perceived social support. They also provided information on the child's early medical history as a measurement of the child's risk level. Two indicators of investment were collected: investment of time in the child's welfare, and levels of depression.

Level of depression was used as an implicit measure of parental investment due to its relationship to unintended emotional and attentional withdrawal (Bugental, Martorell & Barrazza, 2003; Bugental, Beaulieu & Schwartz, 2008; Bugental, et al., 2002).

Current child health was assessed through mothers' report.

Methods

The data were collected in conjunction with a larger study on parental investment that included mothers and fathers of preschool aged children. Data relevant to testing hypotheses amongst mothers will be analyzed here.

Research Participants

The sample involved mothers ($N = 72$) who had at least one child (herein described as the target child) between the ages of 3 and 5. Mothers were recruited using three sources: (1) publicly-posted flyers; (2) flyers distributed to mothers with the assistance of area preschools; (3) the open-network website craigslist.org. Mean age of the mothers was 33.7 (*s.d.* = 6.5). The sample included mothers that self-reported their ethnicity as Caucasian (51.4%), Latina (19.4%), Asian (12.5%), Native American (2.8%), Black/African American (4.2%), and Other/Multiracial (9.7%). Mean maternal education was 15.7 years (*s.d.* = 1.8). Sixty-nine percent of mothers were multiparous of which 76% had one other child besides the target child (mean number of target child's siblings was 0.88 (*s.d.* = 0.74). Eighty-six percent of mothers were either married to or currently living with the father of the target child.

Mean age of target children was 4 years and 2 months (*s.d.* = 12 months). Of the 72 target children, 30 were categorized as high risk based on mothers' self report of health

complications at birth (e.g. preterm, low birth weight). Prior research (Bugental & Happaney, 2004) confirmed that even mild preterm status is a key predictor of later caregiving problems and is employed here as a marker of the target child's low reproductive value (as done previously in Beaulieu & Bugental, 2008).

All mothers gave signed consent to participation using consent forms approved by the campus IRB.

Procedure

Mothers completed demographic measures, health information on the target child, and a social support measure at home and were then invited for a laboratory visit. Risk status of the target child was determined using a mother's response to questions concerning the target child's birth weight, gestational age, and/or early health complications shortly after birth (as done previously in Beaulieu & Bugental, 2008; Bugental et al., 2010).

Measures

Demographic variables. Demographic variables included maternal age, education, ethnicity, marital status, and number of children.

Child Risk Level. Mothers were asked to report the target child's birth weight and indicate whether the child was born preterm (if so, how many weeks preterm). In addition, mothers were asked to report the presence of different kinds of early health problems the target child experienced at birth (examples include low APGAR score, irregular heart rate, and jaundice).

Current Child Health. Mothers answered a single item "What is your child's current health?" on a scale from 1 (poor) to 4 (excellent).

Proportion of Time Spent in Care. Mothers answered multiple items about the time they spent in self-care, general family care, and time interacting with the target child. The item addressing time spent in direct care for the target child was divided by total time spent in care to obtain the proportion of time mothers spent caring for the target child in particular.

Social Support. Mothers completed the Social Provisions Scale (Cutrona & Russell, 1987) at the time of all other measures at home before their lab visit. The instrument consists of 24 items constituting six subscales of four items each: attachment, social integration, reassurance of worth, reliable alliance, guidance, and opportunity for nurturance. All responses are on a 4-point scale indicating to what extent each statement describes the respondents' current social network. Responses range from 1 (strongly disagree) to 4 (strongly agree). All scores are summed to create both the total social support score and subscale scores, such that a high score indicates a greater degree of perceived support. Test-retest reliability coefficients ranged from .37 to .66, and overall internal consistency is acceptable. Cronbach's alpha for the total scale ranged from .91 to .95 across ethnicities.

Among first time mothers, Cutrona (1984) found that the reliable alliance, reassurance of worth, social integration and guidance subscales were predictive of the incidence of postpartum depression.

Depression. Mothers also completed the Beck Depression Inventory (BDI). This instrument provides a commonly used measure of depressive symptoms, validated against

clinical ratings of depression (Beck, Steer & Garbin, 1988). These investigators have found that alpha coefficients measuring internal consistency range from .73 to .92.

Results

Analysis Strategy

Predictions based on the contingent model of investment (see Figure 1) were tested through hierarchical linear regression analysis. Maternal education and ethnicity were included in the first step of all analyses to rule out the effects of socioeconomic status on child health and to demonstrate the universality of the effects of social support across ethnic groups. The main effects of child risk level and mothers' social support (analyzed separately for total social support and subscales) were tested in Step 2. The interaction terms were tested in Step 3. Total social support was tested and then decomposed into its subscales which were each tested in their own individual hierarchical regressions. This allowed us to determine which subscales drove the main effect of total social support. The subscales showing the predicted effects on parental investment were used to test the proposed mediation between parental resources and child health among high risk children (as shown in Figure 2 and 3), using the methods suggested by Baron & Kenny (1986). Risk is coded as high = 1, low = 0 for all analyses.

One case was excluded from all analyses because the mother was unsure as to the current health of the target child. Ethnicity was dichotomized into Caucasian (51.4%) and non-white (48.6%).

Test of central predictions

The first regression tested the effects of total social support and risk level on the proportion of time mothers spent in care for the target child, controlling for maternal education, ethnicity, and the number of other children.

At Step 1, education and ethnicity showed no significant main effects (respectively, b = .002, $p > .05$; b = .012, $p > .05$) but there was a significant main effect of the number of other children in the home (b = -.19, $p < .01$). At Step 2, total support and child risk level did not show significant main effects (respectively, b = -.002, $p > .05$; b = .02, $p > .05$). This indicates that the provision of time in care is not affected by total social support or child risk status. On the final step, the interaction term was also non-significant (b = -.01, $p > .05$). This indicates that the nature of the relationship between total social support and the proportion of time spent caring for the target child does not differ across levels of child risk. See Table 1 for full model.

Table 1.
Regression of Time Spent in Care for Target Child on Total Social Support and Child Risk Status

Step	Variable	B	S.E. (B)	β	R^2 change
Step 1					.38**
	Education	0.002	0.01	0.02	
	Ethnicity	0.01	0.04	0.03	
	Number of other children	-0.19	0.03	-.62**	
Step 2					0.01
	Total Social Support	-0.002	0.003	-0.06	
	Risk Level	0.02	0.05	0.04	
Step 3					0.02
	Social Support x Risk Level	-0.01	0.01	-0.15	

* p < .05
** p < .01

The second regression tested the effects of total social support and risk level on maternal depression, controlling for maternal education and ethnicity.

At Step 1, education and ethnicity showed significant main effects (respectively, b = -1.95, p < .01; b = 5.84, p < .01). At Step 2, total support showed a significant main effect (b = -.64, p < .01) and risk level did not (b = .98, p > .05). This indicates that maternal depression is reduced as total social support increases. On the final step, the interaction term was non-significant (b = -.31, p > .05). This indicates that the nature of the relationship between total social support and maternal depression does not differ across levels of child risk. See Table 2 for the full model.

Table 2.
Regression of Maternal Depression on Total Social Support and Child Risk Status

Step	Variable	B	S.E. (B)	β	R^2 change
Step 1					0.22**
	Education	-1.95	0.56	-0.37**	
	Ethnicity	5.84	1.99	0.32**	
Step 2					0.29**
	Total Social Support	-0.64	0.11	-0.54**	
	Risk Level	0.98	1.68	0.05	
Step 3					0.02
	Social Support x Risk Level	-0.31	0.21	-0.13	

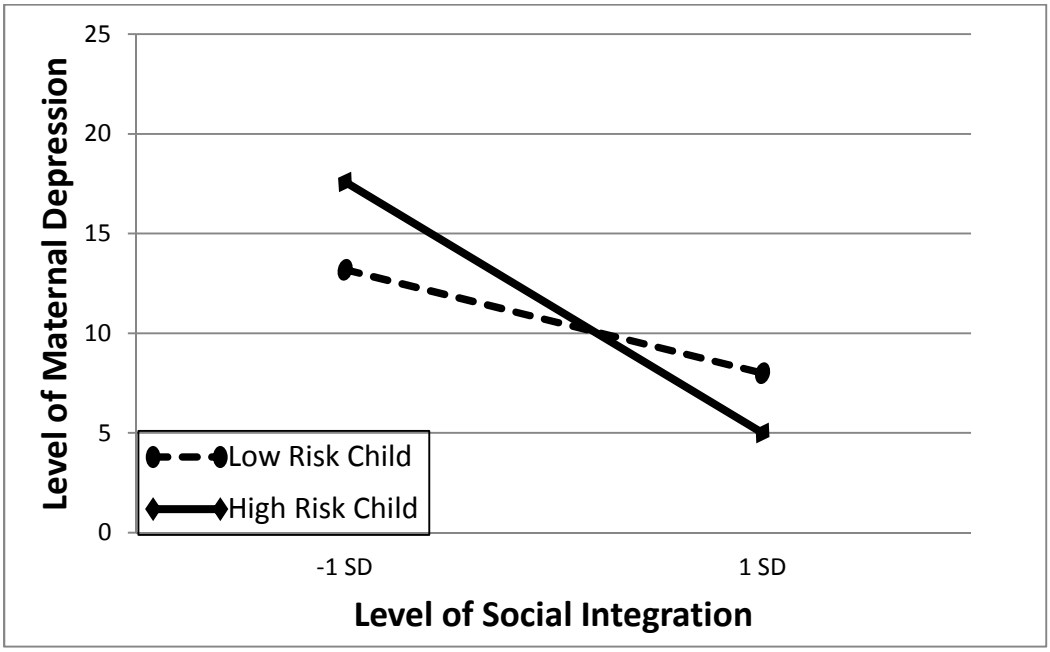
* p < .05
** p < .01

Six additional hierarchical regressions were performed to decompose the main effect of total support; demographics were entered in Step 1, subscale and risk level in Step 2, and subscale × risk interaction in Step 3.

Of the six social support subscales only social integration yielded a significant main effect (b = -2.41, p < .01) and a significant social integration × risk interaction (b = -1.97, p < .05). The interaction showed the predicted contingent pattern with higher perceived social

integration predicting relatively less maternal depression, and lower social integration predicting relatively more depression in mothers with high risk children.

Figure 3. Evidence of contingent pattern for levels of maternal depression according to perceived social support and child risk status. Higher levels of depression are indicative of lower levels of parental investment.



This pattern was similar for mothers of low risk children but these mothers received significantly less relative benefit than mothers of high risk children. See Table 3 for full model.

Table 3.
Regression of Maternal Depression on Social Integration and Child Risk Status

Step	Variable	B	S.E. (B)	β	R^2 change
Step 1					0.22**
	Education	-1.95	0.56	-0.37**	
	Ethnicity	5.84	1.99	0.32**	
Step 2					.24**
	Social Integration	-2.41	0.48	-.49**	
	Risk Level	0.82	1.79	0.04	
Step 3					.04*
	Social Integration x Risk Level	-1.97	0.91	-0.19*	

* p < .05
** p < .01

Test of mediation

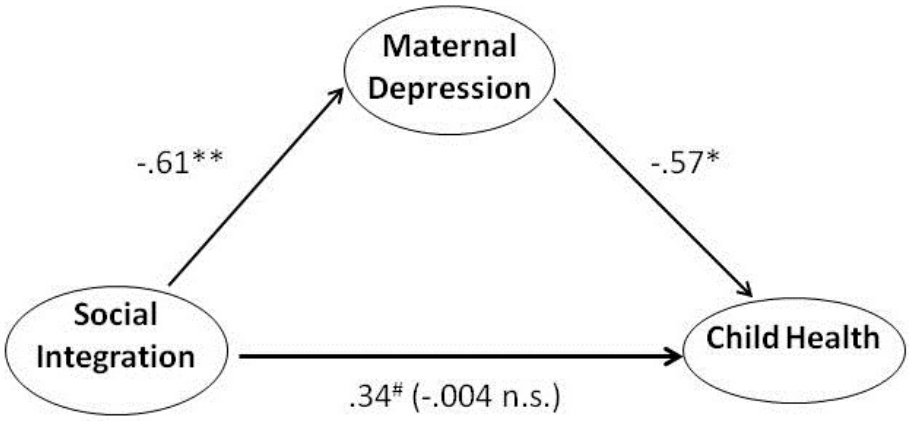
Predictions made for mediating relations were limited to high risk children. No test was made of the mediating effects of maternal investment of time. Maternal social support was uncorrelated with proportion of time spent in caring for the target child (r = -.13, p > .10) so it was not included in mediation analyses. However, a test was made of the mediating effects of maternal depression on the relation between maternal social support and child health.

We examined the hypothesized maternal depression mediation for social integration in the high risk group only. We continued to include maternal ethnicity and education as control variables in each mediation analysis.

In the first stage of analysis, child health was regressed on the social integration subscale. As expected, higher subscale scores predicted better child health, albeit in a marginally significant trend (b = .18, p = .07). In the second stage, BDI was regressed on social integration. As expected, higher social support predicted lower maternal depression (b = -3.33, p < .01). In the final stage, child health was regressed on BDI and social integration simultaneously. As predicted, more maternal depression predicted worse child health (b = -.05, p < .05). In addition, the association between social integration and child health observed in the first stage (b = .18) was attenuated (b = -.002) and the effect became non-significant. The predicted mediation was confirmed (Sobel Z = 2.09, p <.05) in the high risk group (see Figure 4).

Figure 4. Maternal depression as a mediator of the relationship between perceived maternal social integration and child health outcomes (for high-risk children). Coefficients shown are standardized

regression coefficients (betas). The value shown in parentheses represents the predictive power of maternal social integration after being corrected for the mediator (maternal depressive symptoms). *$p < .05$, **$p < .01$, $^{\#}p = .07$



A comparable test made in the low risk group did not approach significance. These results indicate that maternal depressive symptoms are significantly predicted by social support (particularly social integration) and maternal depressive symptoms predict poor child health. These results also replicate previous findings that high risk infants are more sensitive to maternal depressive symptoms (Bugental, et al., 2002; Bugental, Beaulieu & Schwartz, 2008).

Discussion

The current study validates the contingent relationship between social support as a parental resource and maternal depressive symptoms, a manifestation of parental investment, as moderated by child risk status. This study also specifies maternal depressive symptoms as a mediational pathway between maternal social support and child health outcomes.

Consistent with our predictions and prior research (Beaulieu & Bugental, 2008; Bugental, et al., 2002; Beaulieu & Bugental, 2006; Bugental, Beaulieu, & Silbert-Geiger, 2010; Bugental, et al., 2010), we found that the relationship between social support and maternal emotional and attentional investment, indexed by lower depression, was moderated by the risk status of her child. Mothers with more social support, perceived social integration in particular, and low risk children tended to experience fewer depressive symptoms than mothers with lower social support and high risk children. In other words, greater social support predicts lower depressive symptoms for mothers of both low risk and high risk children, but mothers of high risk children benefit more. However, the proportion of mothers' time spent caring for the target child was not significantly predicted by social support or child risk status. There was in fact a very slight negative relationship between social support and time spent in care. This might be because mothers with more social support are better able to solicit others to babysit, such as their own mothers and friends. This reduces the amount of time mothers spend with their own child but does not necessarily reduce the level of care the child receives.

Our mediational hypothesis was also supported. Maternal depressive symptoms provide a potential pathway through which mothers' perceived social support may affect child health outcomes in high risk children. Mothers of high risk children who felt they were receiving better social support tended to report fewer depressive symptoms and better overall health for their child.

Limitations

One limitation of the present research was the method of measurement. All variables, including current child health, were self-reported by the mother. In the future, objective measures

of current child health could be obtained in addition to mothers' report to ensure that mothers' depression status does not influence their evaluations of their child's health. Although the Beck Depression Inventory (Beck, Steer & Garbin, 1988, 1996) and Social Provisions Scale (Cutrona & Russell, 1987) are well validated, it would also be ideal to have multiple measures of maternal depression and social support from sources other than the mother herself.

In addition, these results should be replicated in both less and more affluent samples. Although the sample was reasonably ethnically diverse (49% non-white), mothers had an average of 15.7 years of education, equivalent to an Associate's degree. It would be fruitful to replicate our findings at the extremes of the socioeconomic continuum to assess whether, and how much, the importance of social support varies according to the levels of other parental resources.

Future research can also address the particular types of health issues children of depressed mothers may experience, related to their chronic stress hormone profiles.

Implications

The present research adds to the growing literature in support of the contingent parental investment model (Beaulieu & Bugental, 2008; Bugental, et al., 2002; Beaulieu & Bugental, 2006; Bugental, Beaulieu, & Silbert-Geiger, 2010; Bugental, et al., 2010; Davis & Todd, 1999; Mann, 1992; Bereczkei, 2001) and identifies a key pathway through which parental resource availability can affect important life outcomes for children, such as health.

An evolutionary perspective suggests parents' investment mechanisms should be sensitive to environmental cues, such as the level of support they are receiving from others. Human parents have always relied on the support of others to assist in provisioning themselves

and their families (Kaplan, Hill, Lancaster & Hurtado, 2000). Receiving cues that other people are not willing or able to help should trip a psychological mechanism to either extract more support from others or to disinvest in parenting, as post partum depression is hypothesized to do (Hagen, 2002; Thornhill & Furlow, 1998). It is important to note that we do not expect these differential patterns of investment to be the result of a conscious appraisal process. Instead, we expect parental investment mechanisms to work automatically and outside of conscious awareness. The current study demonstrates precisely this sort of relationship for mothers who experience the highly stressful event of caring for a high risk child (Davis, Edwards, Mohay & Wollin, 2003).

A lack of social support for mothers is a detriment not only to mothers, who experience more depressive symptoms, but also for their high risk children, who tend to experience poorer health. However, our study also carries a hopeful implication; that increasing social support for mothers, especially the feeling of being socially integrated, can ameliorate her depressive symptoms and potentially improve the health of her high risk child. More research is necessary to address how to buffer high risk children from the effects of some mothers' intractable depressive symptoms.

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