

## **The Interactional Model of Maternal-Fetal Attachment: An Empirical Analysis**

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**ABSTRACT:** An Interactional Model of Maternal-Fetal Attachment was empirically studied to analyze contributions of fetal characteristics and psychoanalytic and ecological components. Ninety-nine women during their third trimester were administered questionnaires about themselves, their environment, and their fetus to identify predictors of maternal-fetal attachment. Whether the woman knew the fetus' gender and fetal age were the best predictors of the strength of maternal-fetal attachment. These data suggest that the mother's interactions with her fetus are stronger predictors of attachment than her internal working model or her environment. The findings support an interactional model of maternal-fetal attachment.

**KEY WORDS:** maternal-fetal attachment, interactional model, pregnancy, prenatal bonding

### **INTRODUCTION**

Maternal bonding refers to a pregnant woman's emotional relationship with her child (Klaus, Kennell and Klaus, 1995, p. 192) and begins during pregnancy (Bibring, 1959; Leifer, 1980). A strong maternal bond has been reported to be the foundation for development of prenatal behaviors which include caring for and protecting the fetus (Cranley, 1981). Prenatal caregiving behaviors are directly correlated with reduction of high risk behaviors (Condon, 1985; Leifer, 1977, 1980; Reading, Campbell, Cox and Sledmere, 1982), and failure to reduce high risk behaviors such as drinking and drug use have been associated with increased risk of alcohol related disorders such as fetal alcohol syndrome (FAS) (Jones and Smith, 1973) or alcohol related neurodevelopmental disorders (Warren and

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Foudin, 2001), as well as other deficits that include prematurity (Behnke and Eyler, 1993; Finnegan, 1994; Spence, Williams, DiGregorio, Kirby-McDonnell, and Polansky, 1991), low birth weight (Datta-Bhutada, Johnson, and Rosen, 1998; Zuckerman et al., 1989), poor APGAR scores (Spence et al., 1991), and longer term deficits seen at one month (LaGasse et al., 2003; Mayes, Bornstein, Chawarska, and Granger, 1995), and 12 (Bunikowski et al., 1998), 18 (Rosen and Johnson, 1982), and 24 months (Lewis, Misra, Johnson, and Rosen, 2004). Because attachment may be crucial to the development of prenatal maternal caregiving, identifying variables that influence the strength of the maternal bond is important.

Past research suggests that the mother's attachment to the fetus is generated by psychoanalytic contributions from the mother and ecological contributions from the environment (Doan and Zimmerman, 2003; George and Solomon, 1999). Maternal contributions are primarily derived from attachment theory. Attachment theory suggests that the mother's own attachment experience with her caregiver forms her conception of herself within an attachment relationship (Fonagy, Steele, Moran, Steele, and Higgitt, 1993). This is conceptualized as her internal working model and is the basis for her psychological relationship with her child (Steele and Steele, 1994, p. 111). Maternal qualities that are correlated with the strength of the bond include demographic characteristics. Maternal depression is negatively correlated to maternal-fetal attachment (Hart and McMahon, 2006; Kunkel and Doan, 2003; Mercer, Ferketich, May, DeJoseph and Sollid, 1988) perhaps because depressive symptoms are related to a 'loss of interest in or pleasure in ... activities', or 'having no feelings' (APA, 1994, p. 320; Phipps and Zinn, 1986). Similarly, drinking alcohol may interfere with maternal-fetal attachment because it is classified as a depressant (Valenzuela, 1997). As the Surgeon General advises pregnant women to discontinue alcohol consumption for the health of the pregnancy (Office of the Surgeon General, 2005) continued drinking may indicate a lack of interest in the well-being of the fetus (Reading, et al., 1982) or weak bond to the fetus.

Environmental contributions to maternal-fetal attachment are derived from ecological theory. George and Solomon (1999) argued that limiting the focus of study to microanalysis of attachment relationships ignores important contributions to the development of the bond. They suggest that the attachment relationship is only part

of a complex caregiving-behavioral system which operates within a larger ecological context. Based on their model, maternal-fetal attachment can be strengthened by the environment and by qualities of the pregnant woman. Their notions are supported by Cranley's (1981) finding that the mother's bond with to fetus is positively correlated with social support (Cranley, 1981; Koniak-Griffin, 1988). Other findings show that maternal-fetal attachment is negatively correlated with lack of economic resources (Gaffney, 1986; Mercer *et al*, 1988).

Incorporating the qualities of the pregnancy into a model of maternal-fetal attachment provides another missing link of an ecological systems plus an object relations model. Qualities of the pregnancy include fetal age, whether the pregnancy was the first or a later pregnancy, and the gender of the fetus. Fetal age is positively correlated with maternal-fetal attachment (Grace, 1989; Heidrich and Cranley, 1989) as older age is a proxy for larger fetal size and thus the woman's ability to perceive fetal movement. Research consistently shows that the development of the maternal-fetal bond is positively correlated with the perception of fetal movements (Brazelton and Cramer, 1990; Carter-Jessop and Keller, 1987; Condon, 1985; Grace, 1989; Kemp and Page, 1987; Leifer, 1977; Mercer et al, 1988; Stern, 1995; Zeanah, Carr, and Wolk, 1990). Sensation of fetal movement is a powerful contributor to development of the bond in part because women report that they perceive that the fetus is communicating with her (Doan and Zimmerman, 2003). The first pregnancy is also positively correlated with stronger maternal-fetal attachment (Nichols, Roux, and Harris, 2007) perhaps because the primiparous woman is less aware of the realities of childbearing and depends more upon her fantasies about the fetus. Finally the strength of the bond has been reported to be inversely correlated with knowledge of fetal gender (Wu and Eichmann, 1988). While this finding is counterintuitive it is the only known study of the relationship of fetal gender and maternal-fetal bonding.

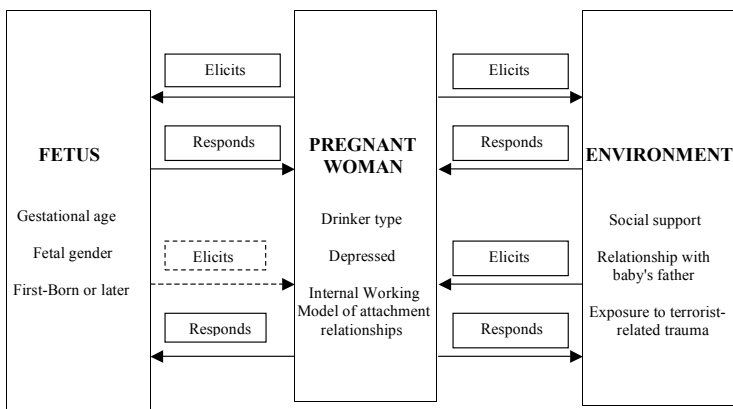
### *The interactional model of maternal-fetal attachment*

In earlier work, M. W. Lewis (2001) adapted M. Lewis and Lee-Painter's (1974) interactional model of the child's behavior to explain maternal-fetal attachment (Figure 1). The model illustrates that between the pregnant women and her environment, interactions occur during which the woman elicits an action or responds to an action from the environment. The model also indicates that, even though the

woman may respond to as well as behave intentionally to elicit an action from the fetus, the fetus can only respond. It does not act intentionally to elicit a response from her. In spite of this, and in large part due to her internal working model of attachment, she may attribute intentions to fetal movement. Her perception of fetal characteristics drives her interpretation that the fetus behaves intentionally to elicit a response from her (See Figure 1). This Interactional Model of Maternal-Fetal Attachment (Lewis, 2001) has been reported elsewhere as a useful clinical tool and this current study is an effort to examine it empirically. The model proposes that the strength of maternal-fetal attachment depends upon three domains: (1) characteristics of the mother; (2) of the environment; and (3) of the fetus. Variables of these domains will be added to this model to determine if an interactional model predicts the strength of maternal-fetal attachment.

**FIGURE I**

*Operalization of Interactional Model of Maternal-Fetal Attachment*



Note: This figure was originally published in the *Journal of Addictions Nursing*, 13 (3/4), 175-185 as the Interactional Model of Maternal-Fetal Bonding. It is reprinted with permission of the International Nurses Society on Addictions.

## METHODS

### *Sample*

Ninety-nine primi- and multi-parous women who were in their third trimester of pregnancy were recruited from four New York City Hospital prenatal clinics. Researchers administered standardized questionnaires that explored maternal characteristics and measured maternal-fetal attachment, drinking behavior, depressed mood, relationship satisfaction, and social support. A woman was excluded if the gestational age of the fetus was <26 weeks, her mental state made it impossible for her to understand questions, she was pregnant with twins, she was not raised in the United States, or she was <18 years old. The IRB for Columbia University, the Columbia University College of Physicians and Surgeons, and the IRB for each New York City hospital (Beth Israel, St. Barnabas, and Harlem) approved the study. Women were told that the study was to learn how best to serve pregnant women and that it would include questions about drinking. Each woman gave her consent to participate.

Women were approached while waiting in the obstetric clinic waiting room. Each woman was asked if she would like to find out more about the “*Mothers’ Project*.” If she said, “Yes,” she was asked questions regarding exclusion criteria. Women who were appropriate for the study were informed about the study in detail. Confidentiality was explained and the research assistant explained that participants received \$20 after completing the questionnaires. Each woman also received a pamphlet from the National Institute of Alcoholism and Alcohol Abuse (NIAAA, 1996) that discussed potential problems for the fetus associated with drinking during pregnancy.

### *Instruments*

Maternal-fetal bonding was operationalized using the Maternal-Fetal Attachment Scale (M-FAS) (Cranley, 1981). The M-FAS is a 24-item, 5-point Likert-type scale that was designed to explore a pregnant woman’s relationship to her fetus. It was normed on women from all socioeconomic (SES) levels and has been used extensively with women from diverse ethnic and economic populations. The M-FAS was adapted for this study by deleting the questions regarding “chose a name for a baby girl” “...baby boy” because many women now choose to learn the baby’s gender during their routine sonogram.

Characteristics of the mother include demographic and clinical characteristics including age, ethnicity, and economic resources,

internal working model of attachment, symptoms of depression, and alcohol drinker type.

The internal working model of attachment was operationalized as the woman's perception of nurturing she received from her mother during childhood and was measured by the Parental Nurture Scale (PNS) (Buri, 1989). The PNS is a 24-item inventory measuring the perceived degree of support, approval, acceptance, and affirmation received from parents. Only questions pertaining to the mother were asked. The PNS was normed on undergraduate students and was difficult for the first five participants to understand. Thus, items were rewritten to make it simpler to understand (e.g. #22: I receive a lot of affirmation from my mother. To Item #22 in the revised version: My mother says a lot of positive things to me about myself).

Drinker type was determined using the Alcohol Use Disorder and Associated Disability Interview Schedule (AUDADIS) (Grant and Hasin, 1991). The AUDADIS is a standardized, nationally representative household study of individuals  $\geq 18$  years. Women who drank 12 drinks during the past 12 months were labeled "current drinkers," women who drank  $\geq 12$  drinks during a 12 month period prior to the 12 months were labeled "ex drinkers," and those who never drank 12 drinks within a 12 month period were labeled "lifetime abstainers."

Depressive symptoms were measured using the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D is a 20 item 4-point scale that measures presence and severity of depressive symptoms over the past seven days. It has been used extensively with low SES samples and is moderately stable over several weeks (Wasserman, Rauh, Brunelli, Garcia-Castro, and Necos, 1990). Because pregnant women often experience two symptoms included in the CES-D (poor appetite, inability to sleep), a revised form was used that eliminated these two items.

Relationship satisfaction with the father of the baby was measured by the Relationship Assessment Scale (RAS) (Hendrick, 1988). The RAS is a 7-item, 5-point Likert scale. The scale was normed on college students and has demonstrated good internal consistency and adequate ability to predict which couples will break up.

The Multidimensional Scale of Perceived Social Support (MSPSS) (Zimet, Dahlem, Zimet and Farley, 1988) measured perceived social support from a special person, family, and friends. The MSPSS is a 12-item, 7-point scale that was normed with an ethnically and socioeconomically diverse population of college students.

Economic resources were assessed by asking the woman to rate on

a scale of 1-6 how adequate her resources have been since she has been pregnant. Responses ranged from 1= "We never have enough to get by from month to month, without assistance" to 6 = "We always have much more money than we need, and usually enough to save every month".

Environmental characteristics also included the impact of the terrorists attack because the women were interviewed shortly after the World Trade Center was attacked on September 11, 2001. Women were asked to indicate what had happened as a result of the attacks and their response was recorded.

Characteristics of the pregnancy were derived from the attachment literature discussed earlier regarding the importance of parity (Nichols, Roux, and Harris, 2007), fetal movement (Grace, 1989; Heidrich and Cranley, 1989), and knowledge of fetal gender (Wu and Eichmann, 1988). The variables included: whether the pregnancy was their first (yes/no); fetal age (weeks); and whether fetal gender was known (yes/no). Whether fetus' gender was known was chosen as the variable rather than what was the gender (male/female) because too few women knew the gender for adequate power (N = 56).

### *Statistical Analyses*

Univariate analyses were conducted using student t-test for continuous variables and the Chi-square test for dichotomous categorical variables. One-way analysis of variance was used to determine descriptive characteristics of variables with more than two components. Non-continuous variables were dummy-coded with the referent variable designated as zero. Dummy-coding for categorical variables "knows fetal gender" and "first pregnancy"; 0 = no, 1 = yes. Reference group for Type Drinker is 0 = Current drinker; and for Ethnicity is 0 = African American. Bivariate analyses were conducted using the Pearson product moment correlation, 2-tailed. Multivariate General Linear Model Hierarchical Regression was used to determine the effect of the independent variables on the dependent variable: maternal-fetal attachment.

## **RESULTS**

### *Descriptive Analyses of Sample*

*Maternal characteristics.* The women ranged in age from 18 - 41 years old. Eighty percent of the sample was  $\leq 30$  years (Mean = 25.8, SD =

5.8). The women's ethnicity reflected the ethnic background of the hospital clinics in New York. Their self-identified ethnicity included African American (55%), Latina (30%), Bi-racial (9%), Caucasian (4%), and Other (2%). This was the first pregnancy for 27.0% of the sample and the number of pregnancies ranged from 1 - 19 (Mean = 4.06, SD = 3.07), births ranged from 0 - 7 (Mean = 1.60, SD = 1.70), and number of abortions ranged from 0 - 9 (mean = 0.99, SD = 1.57). The mean score for the CES-D was 15.1 (SD = 9.7) and ranged from 0 - 44. Ninety-seven women completed the survey questions that measured their perception of their mother's nurturing. Scores ranged from 1.71 - 5 (Mean = 3.93, SD = 0.84). Of the entire sample, 43.4% were lifetime abstainers, 39.4% were ex-drinkers, and current drinkers were 17.2%.

Characteristics of the environment: On average, women reported moderate satisfaction with their relationship with the baby's father (Mean = 3.34, SD = 0.8, range 0.83 - 4.50) and perceived moderate to high social support (Mean = 5.57, SD = 1.2, range 1 - 7). When asked about economic resources since becoming pregnant only a few women (4.0%) reported that they had "much more than they needed", and 14.1% reported that they had "more than needed". Most women (42.2%) reported that they had "just enough to get by without assistance." Over 14% endorsed that they "often didn't have enough to get by without assistance," and 5.1% endorsed they "never had enough to get by without assistance."

The impact of exposure to trauma on 9/11 ranged from 'no effect' to 'a family member died.' The women's answers comprised 18 nominal groups and were treated as a continuous variable.

Characteristics of the pregnancy: Of the total sample, 58.6% knew fetal gender; 13 fetuses were female and 15 were male; 42.4% of the sample preferred their fetus' gender, 10.1% stated that the gender was not preferred, and 6.1% reported they had no preference.

### *Correlational Relationships among Variables*

Table 2 indicates correlations among the criterion and outcome variables. The strongest correlation demonstrates a statistically significant but weak relationship among knowing fetal gender and maternal-fetal attachment ( $r = .300$ ,  $p$ -value  $\leq .01$ ). The relationship among maternal-fetal attachment and gestational age is the next strongest relationship ( $r = .237$ ,  $p$ -value  $\leq .05$ ), also indicating a weak relationship.



**TABLE I**  
*Characteristics of the mother, environment, and fetus*

<i>Characteristics</i>	<i>N</i>	<i>% Sample</i>	<i>Mean (SD)</i>	<i>Range</i>
Maternal-Fetal Attachment Scale			3.97 (0.40)	3.00 - 4.95
Maternal characteristics				
Age (years)			28.8 (5.8)	26.0 - 41.0
Ethnicity				
African-American	54	54.4		
Latina	30	30.3		
Bi-racial	9	9.1		
Caucasian	4	4.0		
Other	2	2.0		
Reproductive History				
Pregnancies			4.06 (3.2)	1 - 19
Births			1.60 (1.7)	0 - 7
Abortions			0.09 (1.6)	0 - 9
Miscarriages			0.42 (0.9)	0 - 6
Stillbirths			0.05 (0.2)	0 - 1
Depressive symptoms			15.10 (9.7)	0 - 44
CES-D scores $\geq 16$	58	58.6		
Parental Nurturance Scale (N=97)			3.93 (0.84)	1.71 - 5
Type Drinker				
Current Drinker	25	25.3		
Ex-Drinker	33	33.3		
Lifetime Abstainer	41	41.4		
Environmental characteristics				
Relationship Satisfaction Scale			3.34 (0.80)	0.83 - 4.50
Multidimensional Social Support Scale			5.57 (1.20)	1.00 - 7.00
Economic resources				
Much more than needed	4	4.0		
More than needed	14	14.1		
Little more than needed	20	20.2		
Just what we need to get by	42	42.2		
Often don't have enough	14	14.1		
Never have enough	6	5.1		
Characteristics of the pregnancy				
Gestational age (week)			33.4 (4.02)	26 - 40
Knows fetal gender	58	58.6		
First pregnancy	27	27.0		

**TABLE 2**  
*Correlations Among Criterion and Outcome Variables*

	Attach	Age	Race	Drink	Depress	Nurture	Support	Father	Resource	9/11	Gestation	Gender	Parity
Age													
Race	-.061												
Drink	.205	-.163											
Depress	-.051	.018	-.037										
Nurture	.089	-.013	.092	-.025									
Support	.080	.034	.007	.032	-.252 <sup>a</sup>								
Father	.029	-.086	-.045	.190	-.327 <sup>b</sup>	.449 <sup>c</sup>							
Resource	.162	-.029	.033	.126	-.139	.165	.072						
9/11	.133	-.171	-.094	.140	-.177	.254 <sup>b</sup>	.224 <sup>a</sup>	.186					
Gestation	-.051	.043	.059	.051	.155	.046	.185	-.082	-.071				
Gender	.237 <sup>a</sup>	.089	.052	-.017	-.036	-.155	-.003	-.079	.031	.031			
Parity	.300 <sup>b</sup>	-.035	.064	-.182	.178 <sup>a</sup>	-.180	-.088	-.001	-.138	-.090	.317 <sup>b</sup>		
	.011	.593 <sup>c</sup>	.027	-.202	.113	-.095	-.219 <sup>a</sup>	.034	-.251 <sup>a</sup>	-.056	-.041	.013 <sup>a</sup>	

Note: N=94. Pearson product moment correlations; 2-tailed tests. <sup>a</sup>  $p$ -value  $\leq .05$ ; <sup>b</sup>  $p$ -value  $\leq .01$ ; <sup>c</sup>  $p$ -value  $\leq .001$ . Dummy coding for categorical variables: "knows fetal gender" and "first pregnancy": 0 = no, 1 = yes. Reference group for "Drink", 0 = Current drinker; "Race", 0 = African American. "Attach" = Maternal-Fetal Attachment Scale score, "Depress" = Depressive symptoms, "Nurture" = Nurturing by one's parents, "Father" = Relationship satisfaction with father of baby, "9/11" = Effect of terrorist attacks, "Gestation" = Gestational age of fetus, "Gender" = Knows fetal gender.

*Hierarchical Linear Regression Analyses*

As shown in Table 3 the first model included maternal characteristics (maternal age, ethnicity, depressive symptoms, internal working model, and drinker type) but was not significant,  $F(5, 88) = 1.12, p\text{-value} = .35$ . The second model added environmental variables (social support, relationship satisfaction, and economic resources) but remained non significant,  $F(9, 84) = 1.53, p\text{-value} = .34$ . The third model reached significance when fetal characteristics were added (fetal age, fetal gender known, and parity),  $F(12, 81) = 1.92, p\text{-value} \leq .05$ . This final model accounted for 22.2% of the variance in the strength of maternal-fetal attachment.

**TABLE 3**  
*Summary of Heirarchical Linear Regression Model*

	Model 1				Model 2				Model 3			
	b	(SE)	B	Sig	b	(SE)	B	Sig	b	(SE)	B	Sig
Step 1												
Constant	3.738	(.303)	--	12.329	.000							
Age	-.002	(.008)	-.032	-.307	.759							
Race	.006	(.037)	.188	1.789	.077							
Drink	-.022	(.051)	-.045	-.432	.667							
Depress	.004	(.005)	.097	.906	.368							
Nurture	.050	(.051)	.105	.985	.328							
Step 2												
Constant				3.238	(.412)	---		7.869	.000			
Age				.001	(.008)	.011		.100	.921			
Race				.071	(.037)	.204		1.928	.057			
Drink				-.043	(.053)	-.087		-.813	.418			
Depress				.006	(.005)	.154		1.354	.179			
Nurture				.017	(.057)	.036		.298	.766			
Support				.022	(.045)	.062		.492	.624			
Father				.079	(.058)	.146		1.359	.178			
Resource				.049	(.039)	.138		1.230	.222			
9/11				-.006	(.008)	-.074		-.685	.495			
Step 3												
Constant								2.502	(.519)	---	4.823	.000
Age								-.004	(.009)	-.055	-.415	.679
Race								.059	(.036)	.169	1.645	.104
Drink								-.011	(.036)	-.023	-.210	.834
Depress								.005	(.005)	.118	1.060	.292
Nurture								.059	(.056)	.124	1.050	.297
Support								.008	(.043)	.023	.190	.850
Father								.073	(.056)	.134	1.293	.200
Resource								.051	(.038)	.145	1.324	.189
9/11								-.003	(.008)	-.045	-.424	.673
Fetal age								.019	(.011)	.190	1.758	.083
Gender								.194	(.089)	.241	2.178	.032 <sup>a</sup>
Parity								.010	(.019)	.072	.539	.592
R <sup>2</sup>		.060			.110				.222			
Adj R <sup>2</sup>		.007			.015				.106			
R <sup>2</sup> change		.060			.050				.112			

Note: N=94. Constant = Dependent variable: Maternal-Fetal Attachment Scale score. b = Unstandardized beta coefficient; SE = Unstandardized standard error coefficients; B = Standardized Beta coefficient. <sup>a</sup> =  $p\text{-value} \leq .05$ . "Drink" = Type drinker, "Depress" = Depressive symptoms, "Nurture" = Nurture by one's parents, "Father" = Relationship satisfaction with father of baby, "9/11" = Effect of terrorist attacks, "Gestation" = Gestational age of fetus, "Gender" = Knows fetal gender.

*Exploratory univariate analysis of variance*

Table 4 demonstrates a one-way analysis of variance exploring the relationship between knowing fetal gender and the strength of maternal-fetal attachment. The independent variable includes two levels: “doesn't know” (N = 40) and “knows” (N = 58) fetal gender and was significant,  $F(1, 96) = 9.431, p = .003$ . Knowing fetal gender accounted for 8.9% ( $\text{Eta}^2 = .089$ ) of the variance in the strength of maternal-fetal attachment. Post hoc analysis was not used because there were fewer than three groups. The data indicate that women who know the gender of the fetus had stronger maternal-fetal attachment scores than women who did not know their fetus' gender. Mean scores among women who knew fetal gender (Mean = 4.07, SD = 0.41) were larger than for women who didn't know their fetus' gender (Mean = 3.83, SD = 0.34),  $F(1, 96) = 4.40, p \leq .05$ .

**TABLE 4**  
*Exploratory Univariate Analysis of Variance*

<i>Type III</i>				
<i>Source</i>	<i>Sum of Squares</i>	<i>df</i>	<i>F</i>	<i>p-value</i>
Corrected model	1.373	1	9.431	.003
Intercept	1475.804	1	10139.979	.000
Knows fetal gender	1.373	1	9.431	.003
Error	13.972	96		
Total	1559.834	98		
Corrected total	15.345	97		

Note: Knows fetal gender = yes or no.  $R^2 = .089$  (Adjusted R Squared = .080).  
Dependent variables: Maternal-Fetal Attachment Scale score.

## DISCUSSION

In conclusion, these data offer tentative support for an Interactional Model of Maternal-Fetal Attachment. The analyses suggest that the model is driven by maternal, environmental, and fetal variables, but the knowledge of fetal gender is the most potent contributor to the bond. The model indicates that the maternal and environmental domains are less important to the strength of the maternal-fetal bond than the mother's relationship to the fetus. Knowing fetal gender as a predictor of prenatal bonding was not anticipated as Wu and Eichmann (1988) found a negative correlation between the variables. Wu and Eichmann reported that the women explained not wanting to know the gender because they didn't have a gender preference. The importance of fetal age to our model of maternal-fetal attachment was supported by other research (Grace, 1989; Heidrich and Cranley, 1989). An explanation is that as the fetus ages it becomes larger, and fetal movements are perceived more often.

Of this sample, 49.5% met CES-D criteria for depressive symptoms. This rate is very high and occurred without two variables which were eliminated to avoid confounding with pregnancy symptoms. Prevalence of depressive symptoms in the sample is elevated compared to 28.0% of a sample of middle-class pregnant women attending childbirth-preparing classes (Raskin, Rishman, and Gaines, 1990). While most depression studies recruit from middle-class populations, higher rates have been found in low-income samples (Hobfoll, Ritter, Lavin, Hulsizer, and Cameron, 1995). Hobfoll and colleagues report that 41.7% of a sample of 192 poor, inner-city pregnant women had elevated depressive symptoms even after adapting the Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mock, and Erlbaugh, 1961) to avoid confounding with pregnancy symptoms. In this sample, a significant inverse relationship emerged among depression and economic resources.

A limitation to this study is that the proportion of women who knew fetal gender was too small to provide enough power to analyze the relationship of gender and maternal-fetal attachment. As mentioned earlier, the overlap between the pregnant woman and the fetus made choosing "knowledge of fetal gender" somewhat artificial. A larger sample is necessary for variability to emerge. Another limitation to the study is the choice of instruments as several were too advanced for this sample of women, many of whom were native Spanish speakers and had difficulty understanding and reading the questions. The instruments were adapted for this sample and while

their reliability was increased, we cannot compare these data to other research using the scales in their unmodified form. Overall, this model predicts the strength of maternal-fetal attachment in a sample of poor, minority women who attended prenatal care at one of three large urban New York City hospitals and the findings cannot be generalized to other populations.

Future research would apply this Interactional Model of Maternal-Fetal Attachment to postnatal attachment with preverbal children. As this model depends upon the characteristics of the child, teasing apart the biopsychosocial variables to determine their impact on post-natal attachment would be an interesting line of research.

Rather than viewing attachment relationships as static, this Interactional Model strengthens the classic psychoanalytic model as well as the ecological model by introducing the contribution of the fetus. Supporting the pregnant woman's developing relationship to the fetus may be fostered by encouraging her to learn the fetus' gender and exploring reasons why the woman declines to learn the gender, if that is the case.

In summary, the Interactional Model of Maternal-Fetal Attachment is a valuable model that incorporates the psychoanalytic model of the woman's internal working model of attachment, the ecological model of the environmental influences on attachment, and fetal characteristics. The mother and environment interact in a bidirectional manner. She may elicit a response from her environment and respond to the elicitations from the environment. The environment may respond to the mother and may elicit responses from her. However interactions between the mother and the fetus are unidirectional. The mother may elicit a response from the fetus, but it only responds. It does not elicit a response from her. Her perception of fetal characteristics drives her interpretation that the fetus behaves intentionally to elicit a response from her. While knowledge of the fetus' gender is significant to the development of the bond, it is the interaction of the mother and the fetus, within the context of the environment that supports the strength of the attachment to the fetus.

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