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The role of stress in low birthweight disparities between Black women and White women: A population-based study

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Abstract

Objective—This study examines the role of stress in low birthweight (LBW) risk in Black and White women in the United States.

Methods—Data from the 1998–2000 Fragile Family Study (FFS) were used ($N=3,869$). We included several self-reported conditions which we categorized as stressors (i.e. socioeconomic conditions, health behaviors, access to quality care, and cultural factors), then we used logistic regression models to analyze the role of stressors in explaining the health disparities in low birthweight between Black and White women.

Results—Most women were unmarried (59% for White women and 87% for Black women). Among unmarried White women, the only stressor associated with a higher likelihood of LBW was smoking (OR=2.0, 95% CI [1.2,3.3]). Among unmarried Black women, smoking (OR=1.7, 95% CI [1.2,2.3]), drug use (OR=1.7, 95% CI [1.0,2.6]), paying for the baby's birth with government resources (OR=1.6, 95% CI [1.1,2.4]), and religious affiliation (OR=1.6, 95% CI [1.0,2.5]) were associated with higher likelihood of LBW. Among married White women, older age (OR=1.1, 95% CI [1.0,1.2]), smoking (OR=5.2, 95% CI [1.7,15.5]), using governmental resources to pay for birth (OR=3.6, 95% CI [1.0,12.4]) and living in governmental housing (OR=9.1, 95% CI [2.0,41.1]) were associated with higher likelihood of LBW. No stressors were statistically significant for married Black women.

Conclusion—We analyzed a large number of stressors at the individual, household, and societal levels and found differences on the stressors among Black women and White women. However, the stressors included in the analyses did not fully explain the racial disparities in LBW.

Keywords

Low birthweight; racial disparity; socioeconomic status; stress

INTRODUCTION

It has been well documented that Black White health disparities exist in infant mortality rates. Previous studies have shown that psychological and physiological stress are associated with poor birth outcomes (1,2,3) such as infant mortality and low birthweight (LBW). In most analyses, researchers utilized one or more of the conventional measures of stress (e.g. negative life events, daily anxieties, psychological distress, or perceived stress) to explore the impact on birth outcomes. Even though stress has been associated with several negative birth outcomes, scholars do not always agree on how to operationalize stress (4-8). For example, Mutale and colleagues (4) defined stress based on a measure of negative life events (4), whereas other studies have defined stress as experiencing daily anxieties (5,6). Others such as Killingsworth-Rini and colleagues (7) operationalize stress as anxiety and/or depression. Nonetheless, one of the most common measures of stress has been perceived stress (8,9). This methodological approach examines how the individual perceives stress rather than measuring the occurrence of stressful events.

However, we believe that the analyses of complex health issues, such as LBW, require the use of multiple dimensions related to stress. We argue that factors beyond the standard measures of stress offer a more thorough explanation of the reason for racial health disparities. Other authors (7-9) asserted that stress can be perceived differently and we hypothesized that the factors examined in this study have a unique relationship to health, more particularly health disparities in birth outcomes. From an all-inclusive perspective, factors such as socioeconomic conditions, health-eroding behaviors, cultural experiences, neighborhood characteristics, and lack of emotional/social support are indicators of stress. For example, we hypothesize that religious association uniquely impact different ethnicities and can serve as a marker of a stressful experience. We believe that this is true for most of our factors explored and the aforementioned stressors differ from perceived stress because they are more antecedent rather than responsive. In particular, a large body of literature on the factors associated with an increased risk of LBW has shown that conventional socioeconomic measures such as educational attainment, income levels, and employment status are strongly associated with racial disparities in pregnancy outcomes (10-13).

This study has two purposes: (1) to examine whether several measures of stress (individual and household socioeconomic conditions, health eroding behaviors, cultural experiences, neighborhood characteristics, and lack of emotional/social support) explain the racial disparities in LBW and (2) to understand the role of stressors on LBW among Black and White women by marital status in the United States.

Data from the Fragile Family and Child Wellbeing Study (FFS), a longitudinal survey of at-risk families and children (beginning at birth), were used to explore the role of stress on racial differences in LBW. The term at-risk refers to unmarried parents, parents who are at greater risk of separating, and those who are more likely to live in poverty compared to traditional families. The FFS is unique because it follows almost 5,000 children born between the years of 1998 and 2000, and assesses at-risk familial relationships including living conditions, patterns of the relationship, the children's performance within the family, and the impact of outside influences (e.g. policy and environmental conditions) on the

family. Specifically, the interviews collect information on behavior, attitudes, demographic characteristics, physical and mental health conditions, and neighborhood characteristics (<http://www.fragilefamilies.princeton.edu/>). Data were collected from United States cities with populations of at least 200,000 individuals from the longitudinal studies. Our study adds to the current literature by exploring a broader measure of stress to explore racial differences in LBW between Black women and White women.

METHODS

Participants

We used data from FFS collected from the years 1998–2000 to analyze the role of stress on LBW disparities in Black and White women. Participants in the FFS study have been followed after one year, three years, five years, and nine years. However, data for this study were based on baseline surveys because the follow-up waves did not contain information on birth outcomes. The participants were Black and White women who reported on their **last birth** ($N = 3,869$) as the unit of analysis, and measures were based on self-reports from the mothers. Even though it is possible for the father of the child to report information on their own stressors, we opted to use information provided by the mothers based on the assumption that their report will yield a more accurate depiction of stressors directly influencing the pregnancy outcomes.

Measures

The dependent variable was LBW. Babies weighing less than 2,500 grams at birth were defined as LBW babies ($n = 425$) and babies over 2,500 grams were classified as normal weight ($n = 3,444$). The independent variables focused on risk factors and stressors for LBW included: individual level SES, health eroding behaviors, household level SES, access to quality care, cultural experiences, neighborhood characteristics, and emotional and social support. All analyses included demographic variables maternal age (in years) and marital status (married vs. unmarried).

The individual-level SES factors were educational attainment and employment. A dummy variable was used reflecting whether the mother had less than high school or high school education or higher (reference category). Employment was measured as based on the number of hours worked during the pregnancy (0=40 hours or less; 1= more than 40 hours). Health-eroding behaviors during pregnancy refer to smoking, drinking alcohol, and using drugs. A dummy variable was included reflecting whether the mother had reported having smoked cigarette during pregnancy (reference category) or never smoked. Response categories for drinking alcohol and use of drugs were every day, several times a week, several times a month, less than once a month and never. Two dummy variables, one for drinking and another for drug use, were constructed to reflect any use (reference category) vs. never. Household socioeconomic factors included income from earnings, dependence on government assistance, and how the individual paid for the birth. A dummy variable was used to reflect whether the mother had any income from earnings (reference category) or not. Three dummy variables (1=yes; 0=no/none) were used to capture dependence on government assistance (whether government resources were used to pay for birth, whether

living in public housing project and receiving housing assistance from government and receiving income assistance from government). Access to adequate prenatal care assesses if the mother received prenatal care in the first trimester. Neighborhood characteristics examined whether the streets around their homes were safe at night (0=no; 1=yes). Cultural experiences were based on two religion variables: religious attendance and affiliation. A dummy variable was used to reflect whether the mother attended religious services (reference category which included hardly, several times a year, several times a month, weekly) or never attended. Religious affiliation was categorized as any (reference category) or none. Emotional and social support was measured based on two characteristics of the romantic relationship. These characteristics are only available for unmarried women in the sample. The first variable refers to whether the boyfriend or romantic partner was not fair or affectionate (reference category) or not. The second refers to whether or not the relationship with boyfriend or romantic partner had ended due to financial reasons, distance, income, relationship reasons, drugs, violence or abuse (1=yes; 0=no).

Statistical Method

Descriptive statistics were conducted using SPSS Statistics Version 19.0 and logistic regressions were performed using STATA S.E. 11.0. Logistic regression models based on weighted data were estimated for each marital status separately to explore the role of stress on the probability of LBW. Complex samples procedures in STATA (svy command) was used in the logistic regression analyses.

RESULTS

Descriptive statistics

Of the 3,869 survey participants in our sample, 2,389 were Black women and 1,480 were White women. Most of the women were unmarried (76.1%) and had educational attainment equivalent to a high school degree or less (63.6%). There were 425 mothers reporting having had babies with low birthweight (314 Black women and 111 White women).

Important differences were identified between Black and White women (Table 1). A higher percentage of Black women reported being unmarried compared to White women ($p < .001$). Black women also reported lower educational attainment than their White counterparts. A higher proportion of White women worked overtime hours (> 40 hours) during pregnancy compared to Black women (11% for White women and 7.6% for Black women). Black women had a statistically higher prevalence of drug use (8.1% for Black women and 3.7% for White women, $p = .029$); however, a higher percentage of White women smoked (23.3% for White women and 21.2% for Black women, $p = .088$). Black women had higher rates of dependency on government resources such as paying for the baby's birth with government resources ($p = .001$), receiving housing assistance from the government ($p = .009$) and no form of income during their pregnancy ($p = .007$). Although only marginally significant, White women had higher rates of access to prenatal care in the 1st trimester ($p = .067$). Black women were more exposed to unsafe streets (20.2%) compared to White women (11.5%) ($p = .011$). In terms of cultural indicators, a higher percentage of Black women reported attending church than White women ($p = .011$). However, a higher percentage of White

women reported having a religious affiliation ($p=.043$). For emotional and social support, a higher proportion of unmarried Black women had an unfair or unaffectionate significant other as well as higher rates of the relationship ending because of stress reasons than their White counterparts.

Logistic Regression Results

Results from the multivariate nested logistic regression model indicate that Blacks were almost 3 times more likely to have a LBW baby compared to Whites in the baseline model. Race remained significant even after SES individual level stressors, health eroding behaviors, SES household stress, access to quality care, cultural experiences, and neighborhood characteristics were included in the analyses. Model 7 indicates that Black women were 2.7 times more likely to have LBW than White women after controlling for all these factors. Model 8 focuses on unmarried women. Results for Model 8 confirm that racial disparities are also relevant for this group in which Black unmarried women were 2.6 times more likely to have a LBW.

Next, analyses desegregated by race and marital status were performed to assess differences between Black and White women (Table 3).

Marital Status

For married mothers, Black race and maternal age were significant SES individual level stress predictors of LBW. Black married women were 2.2 times more likely to have a LBW baby compared to White married women. Higher maternal age was positively associated with LBW among married mothers. Married women who smoked were 3.7 times more likely to have a LBW baby. Married women using government funds to pay for baby birth were 2.3 times more likely to have a LBW and those who depended on the government to pay for housing were 3.4 times more likely to experience a LBW.

For unmarried mothers, significant SES individual level stress predictors of LBW were Black race and work hours per week. Black unmarried mothers were 1.6 times more likely to have a LBW than their White counterparts. Similarly unmarried mothers who worked more than 40 hours a week were 1.5 times more likely to have a LBW baby. Significant historical health eroding behavior stress predictors were smoking and use of drugs. The SES household level stress predictor of LBW that showed significance was using government funds for support during pregnancy (e.g. pay for baby birth), which increased the likelihood of a LBW by 1.5 times.

Marital Status and Race

Among married White mothers, the only significant SES individual level stress predictor of LBW was maternal age (OR=1.10, 95% CI [1.00-1.20]). The only significant health eroding behavior stress predictor was smoking (OR=5.17, 95% CI [1.73-15.49]). The SES household level stress predictors of LBW that showed significance were using government funds for support during pregnancy (i.e. pay for baby birth), which increased the likelihood of having a LBW baby by 3.6 times, and for using government funds for housing, which was also increased the likelihood of having a LBW by 9.1 times. The only predictor of LBW among

unmarried White mothers was smoking, which doubled the likelihood of having a LBW baby.

For married Black mothers, there were no significant predictors of LBW. For unmarried Black mothers, two health eroding behaviors were associated with higher odds of having a LBW: smoking (OR=1.65, CI [1.18,2.32]) and drug use (OR=1.65, CI [1.03,2.64]). The SES household level stress predictor of LBW that showed significance was using government funds for support during pregnancy (i.e. pay for baby's birth) which increased the likelihood of having a LBW by 1.6 times. Religious affiliation was also a marginally significant predictor of LBW and increased the likelihood of a LBW by 1.6 times as well ($p=.052$).

DISCUSSION

The results suggest several predictive stressors for poor pregnancy outcomes for Black women and White women, including SES individual level stressors, SES household level stressors, access to quality care, health eroding stressors, and cultural experiences. Low SES White women who were married had more significant predictors of LBW compared to low SES married Black women. In contrast, Black women who were unmarried had more significant predictors of LBW compared to unmarried White women. The findings have implications for Black women and White women, particularly those 'at risk'. Our findings related to unmarried Black women experiencing more forms of stress, especially those who are lower SES, are consistent with other studies (1, 15-16). However, for low SES White women who are married, dependency on the government may cause a higher level of stress (17,18). Scholars such as Khanani (2010) and Elliot (1996) have hypothesized that this is because White women feel that they should not be in the position where they need to depend on the government for funding, especially since they are married (17,18).

There were also racial differences in religious affiliation and on the impact of religious affiliation on LBW among unmarried women. In our study, Black women reported attendance at religious ceremonies more often than White women; however White women had higher rates of religious affiliation. In some studies, religion has been shown to be negatively associated to LBW (19, 20, 21). Similar to previous studies (21-23), our results indicated higher levels of LBW among unmarried Black women with a religious affiliation. However, no effects were found among White unmarried women. Black unmarried women may be unknowingly criticized as unwed childbearing is not condoned in the religious culture (22). Alternatively, the some religions may encourage divine intervention (21), which may cause a delay in seeking necessary medical treatment. Mann (2010) provides an alternative explanation and suggests that women with higher levels of stress may attempt to cope by seeking comfort in religion (23). Therefore, those under higher levels of stress would be more likely to report being affiliated to a religion.

Past studies have shown that lack of adequate financial resources are associated with anxiety and stress, which can have detrimental effects on pregnancy outcomes, regardless of race (24, 25). Similar results were shown in our study. Financial stress had an impact on White and Black women; however married women were affected more than unmarried women. Married women, regardless of race who had to pay for the baby's birth with government

resources or who received housing assistance from the government were at a greater risk of LBW. The results exemplify the impact that financial stress has on pregnancy outcomes.

Several limitations of our study need consideration in interpreting the findings. Stress is difficult to operationalize. In this study, we generally used similar instruments that were validated in other research studies. Additional work should integrate other racial groups (30) and also different categories of marital status. In the FFS data set, only a binary option for marital status was provided and coded as “yes” or “no” indicating married or unmarried. Nonetheless, it has been shown in research that there is a great deal of difference between women who are single and those who are in a relationship but not married, especially those who are cohabitating. Due to the unavailability of other options for marital status, the exploration of marital differences as forms of stress experiences was limited. Future research should include sub-categories of marital status, as there is likely to be a great deal of difference in stress experience. The FFS sample consists mostly of “at-risk” women. Generalizing the findings to other groups should be implemented with caution. Finally, the FFS baseline was collected between 1998 and 2000, and some of these findings may reflect processes that may have changed over the last years. However, current indicators of infant mortality and low birth weight continue to point out to large differences between Whites and Blacks. Therefore, we believe that many of these factors remain largely significant in addressing disparities between these groups. In addition, the wealth of data from FFS can be used to identify trajectories of these children as they grow older.

This study revealed differences in stressors contributing to LBW for “at-risk” Black and White women. The specific finding in this study that Black women had more stressors compared to White women confirms previous research findings on racial disparities in birth outcomes (1, 8, 10, 13, 16, 17). Finally, our results point to the need of additional study given that other variables may help better explain the racial disparities in LBW.

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Table 1

Characteristics of the participants in study, FFS, 1998-2000

	All Women		White women		Black women	
	% (n=3,869)	LBW (n=425)	% (n=1,480)	LBW (n=111)	% (n=2,389)	LBW (n=314)
<i>SES Individual level stress</i>						
Marital Status						
Unmarried	75.6	86.1	58.5	75.7 [*]	86.9	91.1 [*]
Married	24.4	13.9	41.5	24.3	13.1	8.9
Education Level						
Less than HS	34.7	36.9	28.3	32.4	33.4	38.3
HS or more	65.3	63.1	71.7	67.6	60.6	61.7
Work during pregnancy						
> 40 hours	8.8	11.2	11.0	15.3 [‡]	7.6	9.6 [‡]
40 hours	91.2	88.8	89.0	84.7	92.4	90.4
<i>Health eroding behaviors</i>						
Alcohol						
Yes	10.7	16.8	13.0	16.2	11.0	18.9
No	89.3	83.2	87.0	83.8	89.0	81.1
Smoke						
Yes	19.5	37.3	23.3	46.0	21.2 [‡]	36.7 [‡]
Never	80.5	62.7	76.7	54.0	78.8	63.3
Drugs						
Yes	5.5	14.7	3.7	9.1	8.1 [‡]	17.8 [‡]
Never	94.5	85.3	96.3	90.9	91.9	82.2

[‡] p<.10

^{*} p<.05

^{**} p<.001

Table 2

Odd ratios from nested models of stressor that influence LBW for U.S. Blacks and Whites, FFS, 1998-2000

Variables	Model 1 (n=3,473)	Model 2 (n=3,473)	Model 3 (n=3,473)	Model 4 (n=3,473)	Model 5 (n=3,473)	Model 6 (n=3,473)	Model 7 (n=3,473)	Model 8 ^a (n=2,634)
Black (ref=White)	2.89 ^{***}	2.83 ^{***}	3.18 ^{***}	2.53 [*]	2.53 [*]	2.60 [*]	2.72 [*]	2.63 [*]
Maternal age	0.98	0.99	0.98	0.99	0.99	0.99	1.00	1.00
<i>SES Individual level stress</i>								
Educated (ref=less than HS)		0.77	0.86	1.10	1.09	1.08	1.05	1.07
Hours worked per week>40 (ref=hours <40)		0.82	0.81	0.84	0.84	0.84	0.84	0.84
<i>Health eroding behaviors</i>								
Alcohol use (ref=no use)			2.31	2.38	2.39	2.37	2.35	2.31
Smoke (ref=never)			2.35 [*]	2.10 ^f	2.10 ^f	2.13 ^f	2.03	2.01
Drugs (ref=never)			1.11	0.94	0.94	0.97	0.90	0.90
<i>SES Household level stress</i>								
Income (ref=no income)				0.73	0.73	0.73	0.74	0.75
Pay for baby's birth w/ govt. resources (ref=none)				2.03	2.03	2.02	1.97	1.92
Housing assistance from govt. (ref=no asst.)				1.26	1.26	1.28	1.27	1.29
Income from public assistance (ref=none)				0.87	0.87	0.90	0.91	0.94
<i>Access to quality care</i>								
Prenatal care 1 st trimester (ref=no care)					1.15	1.07	1.19	1.19
<i>Neighborhood Characteristics</i>								
Streets not safe (ref=safe)						0.64	0.62	0.62
<i>Culture</i>								
Religion attendance (ref=never)							0.67	0.66
Religious affiliation (ref=none)							1.43	1.46
<i>Emotional and Social Support</i>								
BF is not fair or affectionate								0.37
Relationship ended (stress reasons)								0.49

Source: Fragile Family Study (FFS) 1998-2000.

Note

^f p<.10

Restricted to unmarried women.

10^{-d}

**

50^{-d}

*

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Table 3

Summary of logistic regression analysis for variables predicting LBW by marital status for the complete sample by race. FFS 1998-2000

	Married				Unmarried			
	Total (n=839)	White (n=464)	Black (n=277)	Total (n=2,634)	White (n=1,480)	Black (n=1,154)	OR	95% CI
Black (ref=White)	2.2 [*] (1.2,4.0)	n/a	n/a	1.6 [*] (1.2,2.1)	n/a	n/a	n/a	n/a
Maternal age	1.1 [*] (1.0,1.1)	1.1 [*] (1.0,1.2)	1.1 (1.0,1.2)	1.0 (1.0,1.0)	1.0 (1.0,1.1)	1.0 (1.0,1.1)	1.0	(1.0,1.1)
<i>SES Individual level stress</i>								
HS or higher (ref=less than HS)	2.1 (0.7, 6.2)	n/a	0.6 (0.2,2.0)	1.0 (0.8,1.3)	1.0 (0.6,1.7)	1.0 (0.7,1.3)	1.0	(0.7,1.3)
Hours worked per week>40 (ref= 40)	1.3 (0.5, 3.2)	0.8 (0.2,3.7)	2.0 (0.6,6.9)	1.5 [*] (1.0,2.2)	1.7 (0.9,3.4)	1.4 (0.9,2.3)	1.4	(0.9,2.3)
<i>Health eroding behaviors</i>								
Alcohol use (ref=no use)	0.8 (0.3,2.2)	0.6 (0.2,2.1)	1.1 (0.2,6.8)	1.2 (0.9,1.8)	1.3 (0.6,2.6)	1.2 (0.8,1.8)	1.2	(0.8,1.8)
Smoke (ref=never)	3.7 [*] (1.7,8.2)	5.2 ^{**} (1.7,15.5)	2.1 (0.6,7.6)	1.8 [*] (1.3,2.3)	2.0 [*] (1.2,3.2)	17 ^{**} (1.2,2.3)	1.7 ^{**}	(1.2,2.3)
Drugs (ref=never)	1.8 (0.2,20.1)	n/a	3.5 (0.2,69.4)	1.6 [*] (1.1,2.5)	1.8 (0.7,4.5)	1.7 [*] (1.0,2.6)	1.7 [*]	(1.0,2.6)
<i>SES Household level stress</i>								
Income (ref=no income)	1.0 (0.5,2.0)	0.9 (0.3,2.3)	1.4 (0.5,4.2)	1.0 (0.8,1.4)	1.0 (0.5,1.9)	1.0 (0.8,1.4)	1.0	(0.8,1.4)
Pay for baby's birth w/ govt. resources (ref=none)	2.3 [*] (1.1,5.0)	3.6 [*] (1.0,12.4)	2.1 (0.8,5.5)	1.5 [*] (1.1,2.1)	1.2 (0.6,2.2)	1.6 [*] (1.1,2.4)	1.6 [*]	(1.1,2.4)
Housing assistance from govt. (ref=no asst.)	3.4 [*] (1.2,9.7)	9.1 ^{**} (2.0,41.1)	1.1 (0.2,5.8)	1.1 (0.8,1.4)	1.6 (0.8,3.4)	1.0 (0.8,1.4)	1.0	(0.8,1.4)
Income from public assistance (ref=none)	1.0 (0.4,2.5)	0.8 (0.2,4.5)	1.0 (0.3,3.6)	0.9 (0.7,1.1)	1.2 (0.7,2.0)	0.8 [†] (0.6,1.0)	0.8 [†]	(0.6,1.0)
<i>Access to quality care</i>								
Prenatal care 1 st trimester (ref=no care in 1 st trimester)	1.9 (0.5,6.6)	1.5 (0.2,13.0)	1.4 (0.3,7.0)	0.8 (0.6,1.1)	0.9 (0.5,1.7)	0.8 (0.6,1.1)	0.8	(0.6,1.1)
<i>Neighborhood Characteristics</i>								
Streets not safe (ref=safe)	0.4 (0.1,1.5)	n/a	0.7 (0.2,2.9)	1.1 (0.8,1.4)	0.8 (0.4,1.7)	1.1 (0.8,1.5)	1.1	(0.8,1.5)
<i>Culture</i>								
Religion attendance (ref=never)	0.8 (0.4,1.6)	0.4 [†] (0.2,1.1)	1.8 (0.5,7.2)	0.8 [†] (0.6,1.0)	0.7 (0.4,1.3)	0.8 (0.6,1.1)	0.8	(0.6,1.1)
Religious affiliation (ref=none)	0.9 (0.3,3.0)	1.3 (0.2,7.5)	0.3 (0.1,2.3)	1.2 (0.8,1.7)	0.6 (0.3,1.2)	1.6 [†] (1.0,2.5)	1.6 [†]	(1.0,2.5)
<i>Emotional and Social Support</i>								
BF is not fair or affectionate	n/a	n/a	n/a	0.9 (0.5,1.9)	1.0 (0.3,4.0)	0.9 (0.4,2.2)	0.9	(0.4,2.2)

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	Married						Unmarried					
	Total (n=839)			White (n=464)			Black (n=277)			Total (n=2,634)		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
Relationship ended (stress)	n/a	n/a		n/a	n/a		n/a	n/a		0.8	(0.4,1.8)	
							n/a	n/a		0.7	(0.2,3.0)	
							n/a	n/a		0.9	(0.3,2.2)	

Note: "n/a" means did not examine the variable or it was omitted because of collinearity.

f
p<.10
* p<.05
** p<.01