Diagnosis Threat and Cognitive Performance During Pregnancy

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Abstract

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It is a common belief that during pregnancy, women’s cognitive abilities decrease, as noted in the popular pregnancy preparation book *What to Expect When You’re Expecting* (Eisenberg & Murkoff, 1996). Many pregnant women report perceiving changes in their cognitive ability during pregnancy, but there are not consistent research findings when using objective neuropsychological tests. One factor potentially contributing to self perceptions of impaired cognition and inconsistent neuropsychological findings is stereotype threat. It is possible that pregnant women believe they are cognitively impaired due to the negative expectations about pregnant women’s cognition that are part of well-known pregnancy stereotypes, and that these negative expectations not only lead them to notice their own normal cognitive errors and attribute them to the pregnancy, but also to sometimes underperform on cognitive tasks.

The purpose of the present study was to investigate whether stereotype threat could be related to self-reported cognitive skills and cognitive test performance in pregnancy. 46 pregnant women in their 2nd and 3rd trimesters were randomly assigned to negative expectancy and control groups and were administered a battery of neuropsychological tests. We hypothesized that women exposed to negative pregnancy stereotypes would self-report more cognitive impairment than pregnant women who were not primed to negative stereotypes. We also hypothesized that pregnant women primed to negative expectations about cognition in pregnancy would perform more poorly on cognitive tests.
than pregnant women not exposed to negative expectations. Results partially supported the hypothesis that participants primed to negative expectations would self report more cognitive impairment. However, results did not support the hypothesis that they would perform more poorly on cognitive tests than pregnant women not exposed to negative expectations. The lack of significant findings may have been due to the failure of the negative expectation manipulation and the high pre-study awareness of the negative stereotypes. However, exploratory analysis showed that, in non-depressed participants, the hypothesis that the negative expectation group would perform more poorly on cognitive tests than controls was supported. Exploratory analysis also showed, for those in the negative expectancy condition, the more a participant agreed with the negative stereotypes, the more poorly they performed on cognitive measures. Future studies should explore depression as a moderator of diagnosis threat effects and consider prior awareness of and agreement with negative stereotypes when examining the role of negative expectations on cognitive performance.

Approved: _____________________________________________________________

Julie Suhr

Professor of Psychology
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Introduction

A well-known stereotype about pregnancy is a decrease in cognitive abilities (e.g. Parsons & Redman, 1991), including forgetfulness, reading difficulties, confusion, disorientation, memory, absent-mindedness and poor concentration (e.g. Casey et al., 1999; Crawley et al., 2003; Poser, 1986; Janes et al., 1999). In fact, this stereotyped phenomenon has been labeled with names such as “porridge brain”, “placenta brain”, and “mammy brain” (Brett & Baxendale, 2001). Even well-known pregnancy books such as What to Expect When You’re Expecting warn pregnant women about cognitive difficulties during pregnancy (Burgoyne, 1994; Parsons & Redman, 1991). Early research on memory difficulties during pregnancy was anecdotal. Two female physicians documented their own cognition during pregnancy and reported problems, most markedly in concentration and a major decline in ability to express themselves verbally (Baildamn, 1991; Burgyne, 1994). Yet, for a stereotype that is so common among pregnant women, there is not conclusive evidence of cognitive impairment in pregnancy.

Consistent with the stereotype, pregnant women frequently self-report cognitive problems in pregnancy, including forgetfulness, concentration, and divided attention as problems (Casey, Huntsdale, Angus, & Janes, Casey, Huntsdale, & Angus 1999; Crawley et al., 2003; Parsons & Redman, 1991; Janes et al., 1999; Sharp, Brindle, Brown, & Turner, 1993). When asked, 82% of women report perceiving changes in their cognitive ability during pregnancy (Parsons & Redman, 1991). However, self-report measures are not the best way to measure or accurately define mental capacity, because people are not very good at estimating their own cognitive abilities (Hermann, 1984).
Research in the last two decades shows a serious discrepancy between subjective findings and objective testing of cognitive changes in pregnancy. Several of these studies were longitudinal in nature, and identified declines in processing speed and verbal memory in the second and third trimester that improved post pregnancy (DeGroot, Hornstra, Roozendaal, & Jolles, 2006; Keenan et al., 1998; Mickes, Wixted, Shapiro, & Scarff, 2009; Rendell & Henry, 2008; Silber et al., 1990). However, other longitudinal studies failed to find significant differences over trimesters and into the postpartum period (Casey, Huntsdale, Angus, & Janes, 1999; Crawley et al., 2003). Furthermore, even in the studies that found differences, the differences were often isolated to only one of multiple tasks administered to the pregnant women. A number of cross sectional studies have found relative deficits in pregnant women in implicit memory (Bringle et al., 1991) and explicit memory performance (Buckwalter et al. 1999; Eidelman, 1993; Sharp et al., 1993), relative to non-pregnant controls. Yet other cross sectional studies failed to find differences between pregnant and non-pregnant groups (Casey, Huntsdale, Angus, & Janes, 1999; Christensen, Poyser, Pollitt, & Cubis, 1999; Mc Dowall & Moriarty, 2000). Similar to the longitudinal research, studies that did find differences between pregnant and non-pregnant groups tended to find differences in only one or two of many tasks administered. For example, Crawley, Grant, & Hinshaw (2008) administered 15 cognitive tasks to pregnant and non-pregnant women in 2 studies, and found group differences on only 2 of the measures. In all studies, pregnant participants reported experiencing more cognitive problems than controls, yet even when relative cognitive weaknesses were found on objective testing, the differences were not serious enough to place participants in the subnormal performance range relative to test norms. Possible factors leading to
inconsistent findings include limited sample sizes, focus on different periods of pregnancy, and failing to exclude women with a history of prior head injury or neurological health issues. The most consistent results of cognitive inefficiencies in pregnancy have been reported in the second and third trimester and on tasks that require both memory and executive functioning skills (often the most difficult tasks in a cognitive battery; Henry & Rendell, 2007). Given these inconsistencies, it is important to look at other variables that might lead to discrepancies in results.

Despite the fact that cognitive findings in pregnancy are inconsistent, some researchers have speculated that biological mechanisms lead to cognition changes during pregnancy. During the 2\textsuperscript{nd} and 3\textsuperscript{rd} trimester, where the most marked cognitive deficiencies have been noted, there are extreme increases in estrogen, progesterone, and glucocorticoids (Brett & Baxendale, 2001; Speroff et al., 1994). Non-pregnancy studies have shown a relationship between better verbal and complex manual skills (Maccoby & Jacklin, 1980) but worse performance on perceptual and spatial skills (Witkin et al., 1962), when estrogen and progesterone levels are high. One study found that when women were administered doses of progesterone comparable to the level in pregnancy, they exhibited impairment in paragraph recall (Phillips & Sherwin, 1992). Cortisol studies have also shown that administration of cortisol at levels comparable to the level people have in their body during a natural stressor leads to poorer performance on declarative memory tasks (Newcomer et al., 1999). However, few studies have directly examined the relationship of hormone changes to cognitive findings in pregnant samples. In a longitudinal study, Buckwalter et al. (1998) found that blood hormones assayed during last 2 months of pregnancy and at 2 months after delivery were not related to
memory test findings. In another longitudinal study, Keenan et al. (1998) tracked cognition and blood hormones during all three trimesters and one time postpartum. Hormone levels were not related to memory test performance.

In addition to hormone changes, there are a number of other factors during pregnancy that might affect cognition, such as pain, trouble sleeping, and depression. Jacobson (2000) found few differences in sleep between pregnant women in different trimesters, but did find that women reported sleeping more at the end of pregnancy. Sleep deprivation studies have shown the negative influence of poor sleep on cognitive performance, such as declines in executive attention, working memory, and higher cognitive functions (Durmer & Dinges, 2005; Harrison & Horne, 2000; Kleitman, 1965; Kribbs & Dinges, 1994). In addition to changes in sleep patterns, depression during pregnancy has been reported as high as 20% (Gotlib et al., 1989). Meta-analyses indicate decreased performance on cognitive tasks in those with depression (Burt et al., 1995; Christensen, Griffiths, MacKinnon, & Jacomb, 1997). A number of studies have postulated that depressed participants are unable to motivate themselves on cognitive tasks or that they are more vulnerable to perceived failure than their non-depressed counterparts (Channon, 1996; Channon & Green, 1999; Elliott, Sahakian, Herrod, Robbins & Paykel, 1997; Elliott, Sahakian, McKay, Herrod, Robbins & Paykel, 1996). Other theorists hypothesize that psychomotor retardation might play a role in cognitive deficits seen in depression (Brebion, Smith & Widlocher, 1997; Hickie, Mason & Parker, 1996; Smith, Brebion, Banquet & Cohen, 1995). Despite these findings, studies of the relation of sleep and depression to cognitive findings in a pregnant sample are few.
One of the few studies to look at this topic was Buckwalter et al. (1998), who examined depressive symptoms specific to pregnancy. Women showed significant impairment on verbal memory during the last 2 months of pregnancy as compared to two months after delivery. Women also reported more negative mood during this period as well. However, they found that depressive symptoms were not related to cognitive performance. Keenan et al. (1998) conducted the longitudinal study described above and found that sleep loss, depression scores, and anxiety scores were not related to cognitive performance. Further, Strothers (2008) found that depression was unrelated to cognitive performance in a sample of pregnant women. Thus, depression has not shown a consistent relationship to cognitive performance in pregnancy. Given that pregnancy commonly leads to sleep disturbance, fatigue, and depression (Harris et al., 1996; Janes et al., 1999; Kane et al., 1968), it is possible that the perception of cognitive problems in pregnancy may be attributable to increased stressors and depression, rather than real cognitive deficits.

In the present study, we proposed that stereotypes about cognition in pregnancy could explain both self-reported cognitive problems and inconsistent cognitive findings in the pregnancy literature. Negative stereotypes about cognition during pregnancy can lead women to expect to perform in line with the stereotype or cause them to feel pressure to disprove the idea of a deficiency. If this is the case, women would subjectively perform more poorly if primed with the stereotype than if they were not primed (Crawley, Grant, & Hinshaw, 2008; Kit, Tuokko & Mateer, 2008). This concept is generally known as Stereotype Threat (Steele & Aronson, 1995). Steele and Aronson (1995, 1997) suggest that negative expectations can compromise performance in individuals who are members
of a group that is expected to underperform on a given task. When a person’s identity such as race, gender, religion, age, or in this case pregnancy status, are attached to a negative stereotype, that person tends to underachieve in a manner consistent with the negative stereotype. Stereotype threat has been observed in neurological populations as well. Suhr and Gunstad (2002, 2005) found that when participants with a history of mild head injury were exposed to the stereotype of head injuries causing major impairment cognition they performed worse on general tests of intellect and immediate and delayed memory when compared to participants who had not been exposed to the stereotype. The same trend was found in older adults, who performed more poorly on cognitive tests when showed words related to negative stereotypes about aging (Levy, 1996; Levy & Langer, 1994; Stein et al., 2002; Yoon et al., 2000). Exposure to negative stereotypes about a participant’s given group can also physiologically increase cardiovascular response to stress, which might be related to poorer performance on cognitive tasks (Blascovich et al., 2001; Levy et al., 2000; Osborn, 2007; Vick et al., 2008).

Stereotype threat in pregnancy was first tested in a pilot study by Suhr & Nemitz (2006), in which 24 pregnant women were randomly assigned to control or negative expectation groups. The negative expectation group was placed in a stereotype threat situation through disclosure that the study they were about to take part in was about cognition during pregnancy. The control group was told the study was about health experiences during pregnancy. Both groups received the same cognitive measures, interspersed among questionnaires about health experiences and pain expectations in pregnancy and delivery to disguise their purpose. In addition, two of the cognitive tasks were disguised as pregnancy related (word list learning of pregnancy words, semantic
fluency task of boy’s names). As expected, the negative expectation group scored significantly worse on the word list learning task (effect size .65) and on a test of semantic fluency (effect size .77). However, no group differences were found in attention, working memory, or delayed recall.

The purpose of the present study was to replicate and expand on the pilot study described above by including a larger sample, assessing both self-reported and actual cognitive performance, checking to see if the stereotype manipulation was actually effective, and also measuring whether participants had been previously exposed to negative pregnancy stereotypes through their pregnancy reading, support groups, or health care providers. We hypothesized that women in their second and third trimester of pregnancy who were primed to negative expectations about cognition in pregnancy would report more cognitive impairment than participants not exposed to the negative expectations on cognitive tasks. In addition, we hypothesized that women exposed to the negative stereotype would perform more poorly on cognitive tasks than pregnant women not primed to the stereotype.

Method

Participants

Women in their second and third trimester were recruited to participate in this study through posters displayed in doctors’ offices (see Appendix B), study information e-mailed to faculty and female students at Ohio University, fliers handed out at local pregnancy fairs, presentations at Lamaze and La Leche league meetings and local pregnancy support groups in Athens County. Each participant was scheduled to participate individually in a half hour session at their home or at the Clinical
Neuropsychology Research Lab in Porter Hall on the campus of Ohio University. Participants were required to be primary English-speakers, have uncomplicated pregnancies, report no current or past drug or alcohol addiction, or head traumas, and be in generally good health (i.e. not suffering from any metabolic, cardiovascular, renal, psychiatric, or neurological disorders). A total of 47 women participated in the experiment (24 controls, 23 experimental). However, data from one control participant was excluded due to a prior head injury and an inability to read.

**Procedure**

Participants were assigned through a computerized randomization program to either Negative Expectancy (NE) or control groups. Participants in the NE group were told that the experiment was assessing cognitive difficulties experienced during pregnancy, while the control group participants were told the experiment was assessing health experiences during pregnancy (with no explicit mention of cognition). These manipulations occurred during the reading of the informed consent forms (see Appendix A).

After signing consent, participants in both groups completed self-report questionnaires. The NE group was given a demographics questionnaire, followed by a self-report questionnaire assessing cognitive symptoms. The control group was given the same demographics questionnaire but then asked to complete a self-report questionnaire that assessed the expectancies of pain during pregnancy, current depressive symptoms, fatigue, and anxiety about motherhood (See Figure 1 for manipulation order). The goal of the experimental order was to further emphasize the manipulation of stereotype awareness for the NE group by drawing their attention to their cognitive abilities through
questionnaires and tests at the beginning of the experiment, while minimizing awareness of the true purpose of the study in the control group.

Following the questionnaires, both groups were administered a brief series of cognitive tests (described below). Following the cognitive tests, the NE group completed the pain, depression, fatigue, and anxiety about motherhood questionnaires, while the control group completed the self-report cognitive symptoms questionnaire. Finally, both groups were given a manipulation check at the end of their assessments.

At the conclusion of the study, each participant was given an oral and written description of the full nature of the study. They were then asked not to share this information with anyone who might participate in the study. Finally, each participant was compensated $20 for their participation.

**Measures**

**Word list learning task.** This task was a variation of many common word list learning tasks used in the memory literature and was used in the pilot study described above (see Appendix C1). For the present experiment, participants were asked to recall a list of pregnancy-related words over 5 trials, and then again after a 15-minute delay. There is no psychometric data on the modified version of this task, although list learning tasks have been well validated as measures of verbal learning and recall (Lezak, 2004). Learning over trials, meaning the scores from the first three trials added together, was used as the dependent variable in the present study.

**Semantic Fluency task.** This task was based on the Verbal Fluency subtest from the Delis-Kaplan Executive Functioning System and assesses cognitive efficiency (Delis, Kaplan & Kramer, 2001). Participants were asked on trial one to list as many boys’
names as they could in one minute (see Appendix C3). On trial two they were asked to list as many girls’ names as they could in one minute. The test-retest reliability coefficient for the original task (boys’ names) is .81, with a retest interval of 25 ± 12.8 days (Delis, Kaplan & Kramer, 2001). Several studies have shown that semantic fluency tasks are sensitive to general cognitive impairment in many neurological populations (Delis, Kaplan & Kramer, 2001). The total number of words named, boys plus girls names, was used as the dependent variable in the present study.

**Demographics.** This form provided basic information about the participants (see Appendix C2).

**Beck Depression Inventory-II.** This instrument was used to screen for self-reported depressive symptoms. The Beck Depression Inventory is a well-validated self-report measure of depressive symptoms (Beck et al., 1996). The test-retest reliability over a 1 to 12 day period in non-psychiatric samples ranges from .82 to .93, and internal consistency is .91 (Sprinkle et al., 2002). The Beck Depression Inventory has strong concurrent validity with other clinical scales of depression such as the MMPI D-scale ($r = .75$) and MMPI-PK scale ($r = .72$) (Conoley, 1992). It has also shown concurrent validity to the Beck Hopelessness Scale ($r = .68$) and the Hamilton Psychiatric Rating Scale for Depression ($r = .71$) (Beck, 1970).

**Pain and pregnancy questionnaire.** This survey was modified from existing studies of pregnancy pain expectancies and was a replication of the form used for the pilot study (see Appendix C4). The intent of this form was to veil the true purpose of the present study and continue the manipulation of expectancy.
Memory Assessment Clinics measures (MAC-S and MAC-Q). These instruments are self-report memory scales (see Appendix C5). The MAC-S contains 51 items, which ask about the self-reported frequency of memory errors all measured on a five-point Likert-type scale. The MAC-Q assesses change in memory from the past; for our purposes, before pregnancy. The MAC-S and the MAC-Q correlate moderately (.41) (Crook, Feher, & Larrabee, 1992). Internal consistency of the MAC-Q was calculated based on Cronbach’s alpha at .57 (p < .001) (Crook, Feher, & Larrabee, 1992). The test-retest reliability for the MAC-Q scales is adequate at .67 over a three week period (Crook, Feher, & Larrabee, 1992). In the present study, the MAC-Q was totaled to reflect the participant’s perceived change in memory ability in pregnancy as compared to before pregnancy. The MAC-S was used as a measure of the participant’s current belief about their memory ability. The internal consistency of the MAC-S was tested in the current study and found to be .90, while the MAC-Q’s internal consistency was .78.

Manipulation Check. This measure asked participants to describe the purpose of the study with an open ended question (“What was the purpose of this study, to the best of your understanding?”). Their responses were coded later by two coders (consensus coding) as indicating the primary purpose was 1) health experiences during pregnancy, 2) pain during pregnancy, 3) cognition/memory during pregnancy, 4) mood during pregnancy, or 5) other (see Appendix C6).

Measure of prior exposure to stereotype. At the end of the study, participants were asked if they had heard any pregnancy and cognition stereotypes prior to enrollment in the study (see Appendix C7). If yes, participants were asked to specify if the stereotypes suggested whether memory would improve or decline. They were also asked
where they had heard about the stereotype, how often they heard it, and how much they believed the stereotype was true. This data was used to measure the prevalence of stereotype knowledge in the sample and whether this might be a confound for the expectancy manipulation.

**Results**

**Demographics**

Means and standard deviations for age, education, and weeks pregnant can be found in Table 2. Pregnant women in the NE group were not different in age, $t(44)=.00$, $p = 1.00$, depression, $t(44)= 1.19$, $p = .23$, education level, $t(44)= -.58$, $p = .56$, or number of weeks pregnant, $t(44)= .75$, $p = .45$, from the control group. Only four participants were of non Caucasian descent, two per group.

**Self-Report Measures**

All hypotheses were directional and thus were tested using one tailed t-tests. Please see Table 3 for a table of all the self-report means and standard deviations.

Pregnant women in the NE group self-reported significantly higher perceived deficiencies in current memory compared to controls, $t(44)=1.67$, $p = .048$, one-tailed. Pregnant women in the NE group tended to self-report higher perceived changes in memory relative to pre-pregnancy ability as compared to controls, although this difference was not significant, $t(44)=1.16$, $p = .13$, one-tailed.

**Objective Cognitive Findings**

Contrary to hypotheses, pregnant women in the NE group were not significantly lower in words remembered from a word learning task as compared to controls, $t(44)= -1.01$, $p = .16$, one-tailed. Pregnant women in the NE group were not significantly lower
on number of names produced in a semantic fluency task compared to controls, \( t(44) = 0.31, p = .38, \) one-tailed.

**Exploratory Analyses**

Given that the second hypothesis was not supported by the data, we explored whether the stereotype manipulation was effective. All but 2 of the 46 participants reported knowing the study was testing memory on the manipulation check measure. We also explored whether the groups had premorbid awareness of negative cognitive stereotypes in pregnancy. All but one of the 46 participants reported being aware of the negative cognitive stereotype. Thus, findings suggest that both groups came into the study highly aware of the negative cognitive stereotypes and that the control group was aware the study was assessing memory, which might explain the lack of group differences.

The two groups weren’t different in their agreement with negative pregnancy stereotypes about cognition, (NE group \( M = 3.00, SD = 1.04, \) control group \( M = 3.18, SD = 1.05, \) \( t(44) = -0.58, p = .56, \) two tailed). Given these results, we conducted an exploratory analysis to see whether belief in the stereotype correlated with cognitive performance, separately by group. We speculated that, if there was some contribution of stereotype threat to cognitive performance, belief in the stereotype would be related to poorer performance only in the group exposed to the negative expectation manipulation. Please see Table 5. In the control group, agreement with pregnancy cognition stereotypes was not related to cognitive performance on either task. In the NE group, agreement with pregnancy cognition stereotypes was not significantly correlated with the cognitive tasks, but the direction of effect was opposite that of the control group, consistent with our
speculations. Because these correlations were in the opposite direction, differences between the correlations were tested using Fisher’s r-to-z. The difference between the two groups’ correlations on the list learning task trended toward significance, $z(44) = .98, p = .16$ (two tailed), as did the difference between the two groups’ correlations on the naming task, $z(44) = 1.4, p = .10$, two tailed.

As stated above, the groups also did not differ on level of depression. However, there were a fair number of people in both groups who were over the clinical threshold for mild depression on the BDI (9 NE and 7 control). Given that depression has been linked to poor cognitive performance as well as decreased motivation in prior research, as reviewed above, we analyzed the data to explore if participants with different levels of self-reported depression would react differently to stereotype threat. We split participants into high depression and low depression groups based on a score of 16 on the BDI. In the NE group 9 were assigned to high depression and 7 in low depression. In the control group 7 were in high depression while 9 were in low depression. We then conducted a series of 2 by 2 ANOVAs (depressed, nondepressed; NE, control) on the list learning task, semantic fluency task, and both self-report memory measures (MAC-S and MAC-Q).

A significant interaction was found between depression and experimental group on the list learning task $F(1,42) = 4.22, p = .05$. Follow-up t-tests showed that, among the depressed participants, there was no difference in list learning scores between the two experimental groups (NE $M = 26.11, SD = 2.31$, controls $M = 25.00, SD = 2.00$, $t(14) = 1.0, p = .32$, two tailed). However, among the non-depressed individuals, participants in the NE group performed significantly worse than controls (NE $M = 23.86, SD = 2.74$, controls $M = 25.00, SD = 2.00$, $t(22) = 2.0, p = .05$).
controls $M = 25.62, SD = 1.78, t(28) = -2.12, p = .05$, two tailed. For semantic fluency, there was no significant interaction, $F(1, 42) = .00, p = .99$, and no significant main effect for depression, $F(1, 42) = .05, p = .83$, or experimental group, $F(1, 42) = .09, p = .72$.

For self-report measures, no interaction was found between depression and experimental group on the MAC-Q, $F(1,42) = .00, p = .952$. However, the main effect of depression was significant, $F(1, 42) = 7.08, p = .01$, with high depressed participants reporting more change in cognition over pregnancy than low depressed participants. No significant interaction was found between depression and experimental group on the MAC-S, $F(1, 42) = 3.31, p = .08$, and the main effects of depression, $F(1, 42) = 1.35, p = .25$, and experimental group, $F(1, 42) = .99, p = .33$, were not significant.

**Discussion**

The purpose of the present study was to replicate and extend the findings of Suhr & Nemitz (2006) with a larger sample, the addition of a manipulation check, and to measure and identify previous exposures to negative pregnancy stereotypes. The present results partially supported the first hypothesis, that pregnant women primed to negative expectations (NE) about cognition in pregnancy would report more cognitive impairment than participants not exposed to the negative expectations. Participants in the NE group self-reported significantly higher perceived deficiencies in current memory based on the MAC-S. Further, as tested by the MAC-Q, pregnant women in the NE group tended to self-report higher perceived changes in memory during pregnancy as opposed to before pregnancy compared with women in the control group, although the difference was not significant. One reason for the lack of findings on the MAC-Q might be its lower internal consistency, which makes that scale less reliable than the MAC-S. In addition,
the power of this analysis was only .32. It would have taken 196 participants per group to reach a significance of .05.

The present results did not support the second hypothesis that women exposed to NE would perform more poorly on cognitive tasks than those who were not primed. Pregnant women in the NE group did not perform significantly worse on the word list learning task as compared to control women, nor did their results significantly differ in number of names produced in a semantic fluency task. These results suggest that, in this sample, stereotype threat did not significantly contribute to differences in cognition during pregnancy. Although, a potential reason for the negative findings is the small sample size. However, the list learning task had a power of .26 and semantic fluency had a power of .09. To reach a significance of .05, it would have taken 282 participants per group based on the list learning task and 2,544 participants per group based on the semantic fluency task. Thus, the non-significant results were not due to a small sample size but more likely due no effect of stereotype threat.

Another reason for the lack of support for the cognitive performance hypothesis might be that the tasks used in the study were not difficult. There is some evidence that stereotype threat effects are stronger when cognitive tasks are more difficult (Neuville & Croizet, 2007; O’Brien & Crandall, 2003; Stricker & Bejar, 2004), although that evidence is mixed (Nguyen & Ryan, 2008).

Another potential reason for the negative findings is that, regardless of which group they were in, all participants except two correctly reported that they believed the study’s purpose was to measure cognition during pregnancy. Additionally, all but one participant reported being aware of the stereotypes about cognition in pregnancy prior to
participation in the study. Thus the manipulation of stereotype salience was likely ineffective in the present study. During the half-hour testing session, a disproportionately large amount of the time was spent on cognitive tasks. Tasks meant to conceal the true purpose of the study, including the Beck Depression Inventory and the Pain and Pregnancy Questionnaire, consumed considerably less time than the cognitive measures.

Through exploratory post hoc analysis, we investigated the relationship between a belief in the stereotype and participants’ objective cognitive results. In the control condition, we found that agreement with the pregnancy stereotype was unrelated to cognitive performance. However, in the NE, as belief in the stereotype increased, performance on both cognitive tasks decreased, although the correlations were not significant. Interestingly, these findings are in contrast to Steele’s (1998) contention that belief in the stereotype should not influence vulnerability to stereotype threat. However, the findings are consistent with the idea that identification with the stereotype may enhance the effect of stereotype threat (Nguyen & Ryan, 2008). These preliminary findings suggest that future research should examine participant’s belief in the pervasive negative stereotypes about cognition in pregnancy. However, these results are entirely speculative and should be followed up with larger samples of pregnant women in future research.

In another exploratory analysis, we explored the role of depression. Past research has shown that depression is related to decreased performance on cognitive tasks (Burt et al., 1995; Christensen, Griffiths, MacKinnon, & Jacomb, 1997). Exploratory analyses showed that, among depressed participants, the two experimental groups did not perform differently on list learning, but among non-depressed individuals, participants in the NE
group performed significantly worse than controls. Thus, it is possible that participants with moderate to severe depression are not further affected by the weak stereotype threat manipulation, because, due to their depression, they already expect to perform poorly. There are, however, some limitations to these findings. First, the BDI-II was given at different times for each experimental group. The control group was given the BDI-II as the third task, before the cognitive tasks, while the NE group was given the BDI-II as the sixth task, after the cognitive tasks. It is possible that the experimental order could have played a role in the way people reported their depressive symptoms. These findings, while interesting, are speculative and should be followed up with a larger sample including depressed and non-depressed women. However, it does suggest the stereotype effect is more influential in those who don’t already have negative expectations.

Results of the present study may not generalize to pregnant women generally, because most participants were college-educated Caucasians. Furthermore, exclusionary criteria specified participants were to be primary English-speakers, have uncomplicated pregnancies, report no current or past drug or alcohol addiction, no past head traumas, and be in generally good health. Thus the sample was likely very healthy pregnant women, and perhaps inclusion of a more diverse sample with regard to health or mental health issues (such as depression) would yield different results.

Future exploration of this study’s hypotheses should seek to better conceal the true purpose of the study from the control participants, as well as seek out a new measure of memory change to replace the MAC-Q. For example, Levy (1996) successfully used subliminal priming of older adults with negative stereotypes of memory in aging, thus finding stereotype threat effects on memory performance even though participants were
unaware of their exposure to negative stereotype words and phrases. Future studies may also explore reasons for the effect of negative stereotypes on both self-report and cognitive performance, such as physiological arousal and cardiovascular reactivity (Blascovich et al., 2001; Levy et al., 2000; Osborn, 2007; Vick et al., 2008).

Should future studies provide more consistent evidence of self-reported cognitive difficulties as in the present study or cognitive differences as in Suhr & Nemitz (2006), it would be important to consider the impact of the findings on pregnant women’s care during pregnancy. Participants in this study indicated pregnancy preparation books such as *What to Expect When Your Expecting*, doctors, friends, movies, and other pregnant women were sources from which they learned about the poor memory performance in pregnancy. However, this is inconsistent with the cognitive test data from prior studies and from the present data; none of the pregnant women in the current study scored in an impaired range. Providing women with accurate information with regard to memory performance in pregnancy could minimize a potential impact of the negative stereotype on their pregnancy experience.
## Table 1
**Summary of Past Research**

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>#PG/CT</th>
<th>Sample Description</th>
<th>Control Description</th>
<th>Compared on</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bringle, 1991</td>
<td>32/9</td>
<td>1st and 2nd PG</td>
<td>Matched</td>
<td>Stem completion, Photo recall, List recall</td>
<td>1st PGN impaired implicit memory as compared to 2nd PGN and CT.</td>
</tr>
<tr>
<td>Buckwalter, 1999</td>
<td>25/0</td>
<td>Uncomplicated PG, tested 20 days prior &amp; 26 days PP</td>
<td>None</td>
<td>Test of Nonverbal Intelligence, CVLT, Boston Naming Test, Digit Span, Trail Making, Stroop</td>
<td>PG impaired in verbal memory before birth versus PP</td>
</tr>
<tr>
<td>Casey, 1999</td>
<td>44/4</td>
<td>22-1st PG 22-2nd PG</td>
<td>Matched</td>
<td>Shipley Institute of Living Scale, Digit span</td>
<td>No differences.</td>
</tr>
<tr>
<td>Casey, 2000</td>
<td>18/1</td>
<td>Started testing in 1st TRI</td>
<td>Matched</td>
<td>Shipley Institute of Living Scale, Digit span, Sentence recall, Category listing task</td>
<td>No difference between groups</td>
</tr>
<tr>
<td>Christensen, 1999</td>
<td>52/3</td>
<td>21 2nd TRI, 31 3rd TRI all over age 27</td>
<td>Matched</td>
<td>Recall task, Dot probe, Stem completion</td>
<td>PG better than CT on PG-related stems</td>
</tr>
<tr>
<td>Crawley, 2003</td>
<td>15/1</td>
<td>Test 2, 3, 6 wks and 1 yr PP</td>
<td>Matched</td>
<td>Stroop, Trail Making, Text memory</td>
<td>No difference between groups.</td>
</tr>
<tr>
<td>Crawley et al, 2008</td>
<td>50/2</td>
<td>25 2nd tri, 25 3rd tri, 25 control</td>
<td>Matched</td>
<td>Immediate and delayed memory, Language processing speed, prospective memory, attention</td>
<td>Nonpreg completed more speed comp.items, 3rd tri slower than 2nd tri and controls on visual elevator task, No difference on all other tasks</td>
</tr>
<tr>
<td>DeGroot et al, 2003</td>
<td>71/5</td>
<td>1st trimester</td>
<td>Matched</td>
<td>Verbal learning, fluency task, concept shifting test, stroop, letter-digit sequencing</td>
<td>Preg group lower on verbal and fluency tasks but not significant difference</td>
</tr>
<tr>
<td>DeGroot et al, 2006</td>
<td>57/5</td>
<td>Tested 14, 17, 29, and 36 week of PG and 32 wks PP</td>
<td>Matched</td>
<td>Concept shifting test, Stroop, Letter digit substitution test, Visual verbal word learning task</td>
<td>Impaired processing speed in early PG, PG had lower list learning scores</td>
</tr>
<tr>
<td>Eidelman, 1993</td>
<td>100/20</td>
<td>All PP</td>
<td>Matched</td>
<td>Logical Memory and Visual Reproduction of Wechsler Memory Scale</td>
<td>PP lower than NPG on first day PP. High risk PG lower than NPG on Logical Memory.</td>
</tr>
<tr>
<td>Harris et al., 1996</td>
<td>20/2</td>
<td>Started testing in last 3 mo of PG, 48 hours after delivery and 4 wks after delivery</td>
<td>Matched</td>
<td>working and long-term memory, information processing, subjective memory, and mood states, to investigate their relationship with any cognitive changes</td>
<td>PG lower scores on digit symbol and paced auditory serial addition tests 48 hrs after delivery. No differences between the groups on logical memory, trail making, or letter cancellation tasks.</td>
</tr>
<tr>
<td>Study</td>
<td>PG/Pregnant</td>
<td>Non-Pregnant</td>
<td>Matched</td>
<td>Primary Measures</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-------------</td>
<td>--------------</td>
<td>---------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Janes et al., 1999</td>
<td>20/2</td>
<td>0</td>
<td>Matched</td>
<td>Implicit, Explicit, &amp; Working Memory</td>
<td>No difference on implicit or explicit memory. PG impaired on working memory as compared to CT.</td>
</tr>
<tr>
<td>Keenan et al., 1998</td>
<td>10/1</td>
<td>0</td>
<td>Matched</td>
<td>Word Stem, NAART, WAIS vocabulary, Logical Memory, California discourse memory test</td>
<td>PG decline in verbal memory from from 2nd to 3rd TRI as compared to controls.</td>
</tr>
<tr>
<td>McDowall et al., 2000</td>
<td>16/1</td>
<td>6</td>
<td>No</td>
<td>Word fragment, Semantic cue recall</td>
<td>No difference between groups</td>
</tr>
<tr>
<td>Mickes et al., 2009</td>
<td>37/0</td>
<td>None</td>
<td>None</td>
<td>Verbal list learning and memory</td>
<td>List learning significantly worst during PG</td>
</tr>
<tr>
<td>Rendell &amp; Henry, 2008</td>
<td>20/2</td>
<td>0</td>
<td>Matched</td>
<td>Prospective Memory</td>
<td>PG impaired in naturalistic measures but not laboratory measures of prospective memory</td>
</tr>
<tr>
<td>Sharp, 1993</td>
<td>48/1</td>
<td>9</td>
<td>Matched</td>
<td>Word-stem, Incidental recall, Repeated recognition of words and photography, Object recall</td>
<td>PG impaired on list recall</td>
</tr>
<tr>
<td>Silber, 1990</td>
<td>20/2</td>
<td>0</td>
<td>Matched</td>
<td>Benton Visual Retention, Associate Learning Test, Simple Reaction Time Test, Pattern Memory Test, Late Recall Test</td>
<td>PG improved compared to CT from 3 to 6 and 12 month after PGN.</td>
</tr>
<tr>
<td>Strothers, 2008</td>
<td>52/0</td>
<td>None</td>
<td>Matched</td>
<td>Boston naming, Letter number sequencing, Digit span</td>
<td>Between 2nd &amp; 3rd TRI acceleration in delayed recall &amp; delay on letter number sequencing.</td>
</tr>
</tbody>
</table>

*Note: PP= postpartum, PG=pregnant, CT=controls, PGN=pregnancy, NPG= nonpregnant, TRI= trimester, MTH= matched for age and education, MEM=memory*
Table 2

*Means and Standard Deviations for Negative Expectancy and Control groups on Age, Depression, Education, Stereotype Agreement, and Weeks Pregnant*

<table>
<thead>
<tr>
<th></th>
<th>Negative Expectancy (n=23)</th>
<th>Control (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Age</td>
<td>27.65 (3.93)</td>
<td>27.65 (3.66)</td>
</tr>
<tr>
<td>Depression</td>
<td>13.78 (5.89)</td>
<td>11.78 (5.47)</td>
</tr>
<tr>
<td>Education</td>
<td>16.96 (1.55)</td>
<td>17.30 (2.40)</td>
</tr>
<tr>
<td>Weeks Pregnant</td>
<td>24.64 (7.53)</td>
<td>23.00 (7.26)</td>
</tr>
</tbody>
</table>
Table 3

*Means and Standard Deviations of Negative Expectancy and Control Groups on Self Report Measures*

<table>
<thead>
<tr>
<th></th>
<th>Negative Expectancy (n=23) M (SD)</th>
<th>Control (n=23) M (SD)</th>
<th>Effect Size r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Memory Difficulty, Memory Assessment Clinics-S (MAC-S)</td>
<td>34.22 (14.27)*</td>
<td>27.35 (13.20)*</td>
<td>0.24</td>
</tr>
<tr>
<td>Change in Memory, Memory Assessment Clinics-Q (MAC-Q)</td>
<td>13.57 (2.83)</td>
<td>12.59 (2.82)</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Note: *p < .05.
Table 4

Mean and Standard Deviations of Negative Expectancy and Control Groups on Word List Learning and Semantic Fluency

<table>
<thead>
<tr>
<th></th>
<th>Negative Expectancy (n=23)</th>
<th>Control (n=23)</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>r</td>
</tr>
<tr>
<td>Word List Learning</td>
<td>24.74 (2.77)</td>
<td>25.43 (1.83)</td>
<td>-0.15</td>
</tr>
<tr>
<td>Semantic Fluency</td>
<td>43.57 (8.54)</td>
<td>42.83 (7.73)</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Table 5

*Summary of Correlations between Stereotype Agreement and Cognitive Variables in Both Groups*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Control Group (n=23)</th>
<th>Negative Expectancy (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r (p)</td>
<td>r (p)</td>
</tr>
<tr>
<td>List Learning</td>
<td>-.09 (.70)</td>
<td>-.38 (.08)</td>
</tr>
<tr>
<td>Semantic Fluency</td>
<td>.19 (.41)</td>
<td>-.25 (.26)</td>
</tr>
</tbody>
</table>
Figure 1.

*Experimental Order*

**Control Group**

1. Demographics
2. Pain Questionnaires
3. Beck Depression Inventory
6. Memory Assessment Center- Self-Report & Questionnaire
7. Manipulation Check
8. Measure of Stereotype exposure

**Negative Expectation Group**

1. Demographics
6. Memory Assessment Center- Self-Report & Questionnaire
2. Pain Questionnaires
3. Beck Depression Inventory
7. Manipulation check
8. Measure of Stereotype exposure
References


Mickes, Laura; Wixted, John T.; Shapiro, Alice; Scarff, J. Michael. The effects of pregnancy on memory: Recall is worse but recognition is not. *Journal of Clinical

PMid:19105075


doi:10.1016/j.jesp.2007.02.007


Appendix A

Ohio University Consent Form
Title of Research: Health Experiences During Pregnancy
Researchers: Dr. Julie Suhr, Adrienne Isgrigg

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study
The purpose of this project is to study health experiences in pregnancy, specifically the nature of cognitive changes (i.e., thinking and memory problems) that pregnant women sometimes report as occurring during pregnancy. If you decide to participate in the study, you will be asked to complete paper-and-pencil questionnaires assessing your experiences of cognitive changes during pregnancy. You will then complete a short series of cognitive test, primarily assessing memory and processing speed. Finally, you will complete some questionnaires looking at your current depressive symptoms and your experiences of and expectations for pain during labor. Participation should take no more than one hour.

Risks and Discomforts
There are minimal risks associated with this project. Sometimes people are uncomfortable answering questions about their experience of cognitive problems, pain, or depression. If you are uncomfortable with any of the questions, please let the examiner know.

Benefits
We hope that the results of the study will provide a better understanding of the health experiences of pregnant women, and may help in designing interventions to address some of their health concerns.

Confidentiality and Records
All data will be collected in a confidential manner. All data forms will record only a participant identification number, which will not be connected to your name or other identifying information in any way. This consent form will be stored separately from that data. All data will be stored in a locked filing cabinet in the locked research office of the Principal Investigator.

Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:
Appendix A (continued)
Ohio University Consent Form

* Federal agencies, for example the Office of Human Research Protections, whose responsibility is to protect human subjects in research;

* Representatives of Ohio University (OU), including the Institutional Review Board, a committee that oversees the research at OU;

Compensation
To compensate you for your time, you will be paid $20. Participants who complete only part of the study will only be compensated for the part they complete (i.e., participants who stop halfway through would be compensated 5 dollars).

Contact Information
If you have any questions regarding this study, please contact Dr. Julie Suhr, 593-1091, suhr@ohio.edu or Adrienne Isgrigg, (740) 593-0910 or ai340407@ohio.edu.

If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593-0664.

By signing below, you are agreeing that:

- you have read this consent form (or it has been read to you) and have been given the opportunity to ask questions
- known risks to you have been explained to your satisfaction.
- you understand Ohio University has no policy or plan to pay for any injuries you might receive as a result of participating in this research protocol
- you are 18 years of age or older
- your participation in this research is given voluntarily
- you may change your mind and stop participation at any time without penalty or loss of any benefits to which you may otherwise be entitled.

Signature_________________________ Date________

Printed Name_________________________

08/20/08

Version Date: [insert]
Appendix A (continued)
Ohio University Consent Form

Title of Research: Health Experiences During Pregnancy
Researchers: Dr. Julie Suhr, Adrienne Isgrigg

You are being asked to participate in research. For you to be able to decide whether you want to participate in this project, you should understand what the project is about, as well as the possible risks and benefits in order to make an informed decision. This process is known as informed consent. This form describes the purpose, procedures, possible benefits, and risks. It also explains how your personal information will be used and protected. Once you have read this form and your questions about the study are answered, you will be asked to sign it. This will allow your participation in this study. You should receive a copy of this document to take with you.

Explanation of Study
The purpose of this project is to study health experiences in pregnancy, specifically pain experiences and expectations for pain during labor. If you decide to participate in the study, you will be asked to complete paper-and-pencil questionnaires assessing your experiences of current pain and your expectations for pain during labor, as well as self-reported depressive symptoms. You will also complete a short series of thinking and memory tasks and will also complete self-report instruments assessing your sense of your cognitive skills. Participation should take no more than one hour.

Risks and Discomforts
There are minimal risks associated with this project. Sometimes people are uncomfortable answering questions about their experience of pain, depression, or cognitive problems. If you are uncomfortable with any of the questions, please let the examiner know.

Benefits
We hope that the results of the study will provide a better understanding of the health experiences of pregnant women, and may help in designing interventions to address some of their health concerns.

Confidentiality and Records
All data will be collected in a confidential manner. All data forms will record only a participant identification number, which will not be connected to your name or other identifying information in any way. This consent form will be stored separately from that data. All data will be stored in a locked filing cabinet in the locked research office of the Principal Investigator. Additionally, while every effort will be made to keep your study-related information confidential, there may be circumstances where this information must be shared with:
Ohio University Consent Form

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**Compensation**

To compensate you for your time, you will be paid $20. Participants who complete only part of the study will only be compensated for the part they complete (i.e., participants who stop halfway through would be compensated 5 dollars).

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If you have any questions regarding this study, please contact Dr. Julie Suhr, 593-1091, suhr@ohio.edu or Adrienne Isgrigg, (740) 593-0910 or ai340407@ohio.edu.

If you have any questions regarding your rights as a research participant, please contact Jo Ellen Sherow, Director of Research Compliance, Ohio University, (740)593- 0664.

By signing below, you are agreeing that:

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- known risks to you have been explained to your satisfaction.
- you understand Ohio University has no policy or plan to pay for any injuries you might receive as a result of participating in this research protocol
- you are 18 years of age or older
- your participation in this research is given voluntarily
- you may change your mind and stop participation at any time without penalty or loss of any benefits to which you may otherwise be entitled.

Signature________________________________________ Date__________

Printed Name_____________________________________________

Version Date: [insert 08/20/08]
Appendix B

Sample Recruitment Flier

Pregnant?

Interested in helping science?

The psychology department at Ohio University is conducting a study exploring health experiences during pregnancy. Your participation would take approximately one hour, and you will complete several questionnaires and paper and pencil tests. All information would be confidential.

Participation will be limited to the first 60 eligible women who contact the lab.

As compensation for your time, all participants will be paid $20.

If you are
- Currently pregnant
- In your second or third trimester
- Between the ages of 19-34
- Have no other medical conditions or diagnoses

If you or someone you know is interested in participating, please contact Adrienne Isgrigg (740) 593-0910 or ai340407@ohio.edu
Appendix C1

Copy of Instruments
Cognitive Tests

<table>
<thead>
<tr>
<th>Word List Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID NUMBER</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List A</th>
<th>List B</th>
<th>Immed Recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recall</td>
<td>(Don't say words)</td>
<td></td>
</tr>
<tr>
<td>Baby___</td>
<td>Mother ___</td>
<td>Baby ___</td>
</tr>
<tr>
<td>Bottle___</td>
<td>Breast ___</td>
<td>Bottle ___</td>
</tr>
<tr>
<td>Diaper___</td>
<td>Crib ___</td>
<td>Diaper ___</td>
</tr>
<tr>
<td>Sleep ___</td>
<td>Stroller___</td>
<td>Sleep ___</td>
</tr>
<tr>
<td>Playpen___</td>
<td>Nurse ___</td>
<td>Playpen ___</td>
</tr>
<tr>
<td>Birth ___</td>
<td>Doctor___</td>
<td>Birth ___</td>
</tr>
<tr>
<td>Hospital___</td>
<td>Womb___</td>
<td>Hospital___</td>
</tr>
<tr>
<td>Pain ___</td>
<td>Labor___</td>
<td>Pain ___</td>
</tr>
<tr>
<td>Carseat ___</td>
<td>Blanket___</td>
<td>Carseat ___</td>
</tr>
<tr>
<td>Stitches ___</td>
<td>Rattle___</td>
<td>Stitches ___</td>
</tr>
</tbody>
</table>

**TOTAL ___ ___ ___ ___ ___ ___ ___**

Total over all trials = ___

20' DELAYED RECOGNITION (circle if correct, X if incorrect)

<table>
<thead>
<tr>
<th>BOTTLE</th>
<th>PAIN</th>
<th>BABY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>
BLANKET N  WOMB N  LABOR N
SLEEP Y  CAR SEAT Y  MOTHER N
RATTLE N  BREAST N  BIRTH Y
STROLLER N  PLAY PEN Y  NURSE N
DIAPER Y  CRIB N  STITCHES Y
DOCTOR N  HOSPITAL Y  FATHER N

20 MIN TOTAL Y___ OF 10     TOTAL FALSE
POSITIVE___OF 10

Appendix C2

Copy of Instruments
Demographic Information Sheet

ID NUMBER______________ AGE________
EDUCATION________
ETHNICITY______________CURRENT EMPLOYMENT
STATUS______________
NUMBER OF WEEKS PREGNANT__________ ANTICIPATED DELIVERY
DATE___________

HAVE YOU HAD A HEAD TRAUMA IN THE PAST?   Y   N
HAVE YOU SUFFERED FROM EPILEPSY OR A BRAIN TUMOR?   Y   N
HAVE YOU EXPERIENCED COMPLICATIONS DURING YOUR
PREGNANCY?   Y   N
DO YOU NOW OR HAVE YOU EVER HAD A DRUG OR ALCOHOL
PROBLEM?   Y   N

________________________
GROUP ASSIGNMENT       NE       CONTROL

WORD LIST TASK TRIAL 1____  2____  3____  LIST B____  IR____  DR____
RECOG____  FP____

WORD FLUENCY TASK (TOTAL WORDS) _____

MAC- S______________  MAC- Q______________
BDI___________________
Appendix C3

Copy of Instruments
Cognitive Tests

SEMANTIC FLUENCY TASK

ID NUMBER

I WOULD LIKE YOU TO NAME, AS QUICKLY AS YOU CAN, ALL THE BOY’S NAMES THAT YOU CAN THINK OF. YOU WILL HAVE 1 MINUTE TO THINK OF AS MANY AS YOU CAN. READY, BEGIN.

TOTAL NUMBER OF WORDS

THIS TIME, I WOULD LIKE YOU TO NAME, AS QUICKLY AS YOU CAN, ALL THE GIRL’S NAMES THAT YOU CAN THINK OF. YOU WILL HAVE 1 MINUTE TO THINK OF AS MANY AS YOU CAN. READY, BEGIN.
Appendix C4

Copy of Instruments
Pain and Pregnancy Questionnaire

ID NUMBER__________________________

HEALTH AND PREGNANCY QUESTIONNAIRE

1. HAVE YOU CHANGED YOUR DIET DURING YOUR PREGNANCY?
   □ NO  □ YES

2. DO YOU TAKE MULTIVITAMENS TO SUPPLEMENT YOUR DIET?
   □ NO  □ YES

3. HOW MANY HOURS OF SLEEP DO YOU GET A NIGHT?
   □ 0-4  □ 5-6  □ 7-8  □ 9-10  □ 11+

4. AT WHAT TIME DO YOU NORMALLY GET UP IN THE MORNING?
   BEFORE 5AM □ 5-6AM □ 7-8AM □ 9-10AM □ 11AM OR AFTER

5. HOW MANY TIMES IN A NIGHT DO YOU WAKE?
   □ 0  □ 1-2  □ 3-4  □ 5+

6. HAVE YOU EXPERIENCED A CHANGE OF SLEEP DURING YOUR PREGNANCY?
   □ NO  □ YES  IF YES, ARE YOU GETTING MORE OR LESS_________

7. ARE YOU IN PAIN TODAY?
   □ NO  □ YES  IF YES, PLEASE RATE BETWEEN 1-10 (1=LOW
   10=HIGH)________

8. HOW PAINFUL DO YOU EXPECT YOUR LABOR TO BE? (PLEASE CHECK)
   NO PAIN  UNNOTICEABLE  MILD  MODERATE  STRONG  SEVER

9. HOW NERVOUS OR ANXIOUS ARE YOU ABOUT LABOR PAIN? (PLEASE CHECK)
   NOT AT ALL  MILDLY  MODERATE  STRONGLY  SEVERLY

10. WHAT LEVEL OF CONTROL DO YOU THINK YOU WILL HAVE OVER YOUR LABOR PAIN?
    COMPLETE  HIGH  MODERATE  FAIRLY LOW  POOR  NONE
11. PLEASE RATE YOUR CURRENT LEVEL OF DAILY FATIGUE

<table>
<thead>
<tr>
<th>UNNOTICEABLE</th>
<th>MILDLY</th>
<th>MODERATE</th>
<th>STRONGLY</th>
<th>HIGHLY</th>
<th>SEVERELY</th>
</tr>
</thead>
</table>

12. WHAT PAIN COPING STRATEGIES DO YOU PLAN TO USE DURING DELIVERY? (CIRCLE ALL THAT APPLY)

- BREATHING TECHNIQUES
- DISTRACTION
- EPIDURAL
- RELAXATION
- NITROUS OXIDE
- PHYSICALLY MOVING AROUND
- NARCOTICS
- NO PLANS TO USE ANY STRATEGIES
- MEDITATION
- OTHER (DESCRIBE)...

Appendix C5
Copy of Instruments
Self-report Rating of Current Cognitive Abilities

**ID NUMBER**

PLEASE RATE HOW OFTEN YOU DO THE FOLLOWING THINGS:

<table>
<thead>
<tr>
<th>HOW OFTEN DO YOU...</th>
<th>Very Often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Very Rarely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Go into a room to get something and forget what you are after?</td>
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<tr>
<td>Forget to bring up an important point you had intended to mention during a conversation?</td>
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<tr>
<td>Forget that you told someone something and tell them again?</td>
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<tr>
<td>Have difficulty recalling a word you wish to use?</td>
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<tr>
<td>Have to stop and think when distinguishing left from right?</td>
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<tr>
<td>Forget an entire event, such as attending a party or having a visitor?</td>
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<tr>
<td>Miss the point someone else is making during a conversation?</td>
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<tr>
<td>Feel that a word or name you want to remember is ‘on the tip of your tongue’ but cannot be recalled?</td>
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<tr>
<td>Forget the name of a familiar object?</td>
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<tr>
<td>Call someone you recently met by the wrong name?</td>
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<tr>
<td>Fail to remember a name or word when trying, but recall it later?</td>
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<tr>
<td>Dial a number and forget whom you were calling before the phone is answered?</td>
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<tr>
<td>Forget an appointment or other event that is very important to you?</td>
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<tr>
<td>Take a surprisingly long time to recall a fact that you know quite well (and do eventually remember)?</td>
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<tr>
<td>Have difficulty following a conversation when there are distractions in the environment such as noise from a TV or radio?</td>
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<tr>
<td>Forget which waiter took your order in a restaurant?</td>
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<td>Have to re-read earlier paragraphs from a newspaper or magazine story to understand the point?</td>
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<tr>
<td>Pass the point where you intended to exit while driving a car or public transportation?</td>
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</tr>
<tr>
<td>Task</td>
<td>Much Better Now</td>
<td>Somewhat Better Now</td>
<td>Same</td>
<td>Somewhat poorer now</td>
<td>Much poorer now</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
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<tr>
<td>Fail to recognize people who recognize you?</td>
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<tr>
<td>Have trouble finding your place again when interrupted in reading?</td>
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<tr>
<td>Arrive at the grocery store or pharmacy and forget what you intended to buy?</td>
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<tr>
<td>Meet people who seem familiar but can’t remember where you met them?</td>
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<tr>
<td>Confuse a word with another when they sound the same?</td>
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<tr>
<td>Store an important item in a place where it will be saved and then forget where it is?</td>
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</tr>
</tbody>
</table>

Appendix C5 (continued)
Copy of Instruments
Self-report Rating of Current Cognitive Abilities

**ID NUMBER**

**MAC- Q (REVISED)**

As compared to your experiences prior to pregnancy, how would you describe your ability to perform the following tasks?
Recalling where you have put objects (i.e. keys)

Remembering specific facts from a newspaper or magazine article you have just finished reading

Remembering the items you intended to buy when you arrived at the grocery store or pharmacy

In general, how would you describe your memory and thinking skills as compared to prior to your pregnancy

**Appendix C6**

Copy of Instruments
Manipulation Check

**Id code**

What was the purpose of this study, to the best of your understanding?
Appendix C7

Copy of Instruments
Measure of Prior Stereotype Exposure

Id code__________________

1. Prior to this study did you hear or read any stereotypes about cognition in pregnancy? (please circle your answer)
   Y         N (if No, then stop here)

If yes, answer the questions below:

2. Whom did you hear stereotypes from? (circle all that apply)
   Books                          Spouse
   Magazines                      Friends
   TV show                        Parents
   Radio                          Lamaze Classes
   Movie                          Doctor
   Other pregnant women          Other:________________________

3. The stereotypes about cognition and pregnancy said: (circle the one you heard most)
Cognitive abilities improved during pregnancy
Cognitive abilities decreased during pregnancy

4. How often did your hear this stereotype (circle one)
   Constantly      Often      Rarely      Once or twice

5. How much do you believe the stereotypes about cognition and pregnancy?
   Strongly Agree- - - - - - - - - - - Agree- - - - - - - - - - - Neutral- - - - - - - - - - - Disagree- - - - - - - - - - - Strongly Disagree

6. Did you change the activities or things that you did because of what you had heard about cognition in pregnancy?
   No   Yes   If yes, what did you change:

7. Did you try to avoid tasks based on what you had heard about cognition in pregnancy?
   No   Yes   If yes, what did you avoid:

Appendix D

Debriefing Form

The purpose of the study was to examine health experiences in pregnancy. Although some participants were led to believe our focus was on pain expectation, our particular interest was actually on the experience of cognitive changes associated with pregnancy. We needed to mislead some participants in order to manipulate their expectations for changes to their cognitive abilities in pregnancy.

Women sometimes report that their cognitive skills decline during pregnancy. However, existing studies do not provide clear and convincing evidence that there are cognitive declines during pregnancy when cognitive skills are actually tested.

Why might women feel as though their cognitive skills are changing? Researchers have suggested that hormone changes, experiences with depression, anxiety, pain, or sleep/fatigue may contribute to the perception of cognitive change. What is hopefully reassuring to you is that there is not strong evidence to support the negative stereotype of pregnancy-related cognitive decline.

In this study, we were specifically examining whether simply exposing pregnant women to the negative stereotype could alter their expectation of their own cognitive skills and potentially even alter their cognitive performance. We hypothesized that this might occur, as there is substantial evidence linking negative expectation about many physical symptoms (including cognitive
symptoms) to actual experience of those symptoms (sort of a “self-fulfilling prophecy”). In fact, for some disorders when negative expectations play a large role in the experience of symptoms, interventions have been designed to counteract these negative expectations. Thus, learning about the role of negative expectations and their influence on beliefs about cognitive skills in pregnancy could lead to better education for pregnant women, or even intervention techniques for those who have severe concerns about their cognitive skills.

We thank you for your participation. Please remember not to discuss the true purpose of our study with any of your pregnant friends, who may also want to participate in the study, so as not to unduly influence our results.

If you have serious concerns about your own cognitive skills or are feeling distressed about pain or feeling depressed, we urge you to discuss your concerns with your obstetrician. You can also contact Tri County Mental Health and Counseling Services at 592-3091. Finally, Dr. Suhr can provide you with a free clinical cognitive evaluation through the Ohio University Psychology and Social Work Clinic if you wish; you can contact her at 593-1091.