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STUDYING THE RELATIONSHIP BETWEEN QUALITY OF PRENATAL CARE AND  
SUBSTANCE USE IN BIRTH MOTHERS

NIKITA NAGPAL  
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Reviewed and approved\* by the following:

Jenae M. Neiderhiser  
Liberal Arts Research Professor of Psychology  
Thesis Supervisor

Katriona Shea  
Associate Professor of Biology  
Honors Adviser

\* Signatures are on file in the Schreyer Honors College

### **Abstract**

The current study examined the relation between maternal responsibility toward prenatal care and different types of prenatal substance use. Data were collected from 554 mothers who completed an adoption plan. Prenatal substance use was examined as a predictor of the number of prenatal visits and prenatal vitamin use. Results showed negative relations between factors of responsible maternal prenatal care and substance use during pregnancy. This suggests that there are particular prenatal care behaviors associated with prenatal substance use. It is important to identify behaviors associated with prenatal substance use in pregnant women for future research, as well as intervention and prevention.

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## **Introduction**

Prenatal care, consisting of both medical visits and personal care habits such as regular use of prenatal vitamins, has been recognized as an important component of medical care during pregnancy as it has been shown to positively affect the overall health and outcome of both the infant and mother. A number of barriers to achieving adequate prenatal care have been identified, including maternal prenatal substance abuse. However, there is currently a lack of research on related behavioral trends of substance using mothers. Therefore, the current study will examine how responsibility towards obtaining adequate prenatal care is related to tobacco, alcohol and licit/illicit drug use during pregnancy.

## **Prenatal Care**

Prenatal care is important for monitoring the health of a mother and developing fetus and for delivering medical, educational and supplementary services (Schempf & Strobino, 2008). The primary objective of prenatal care is for a pregnancy to result in a healthy infant and mother. Health providers aim to optimize pregnancy outcomes by identifying risk factors for pregnancy complications or other maternal health concerns needing to be addressed. Health providers are able to monitor the ongoing “health” of a pregnancy through a series of screening and diagnostic tests. Issues that are assessed in prenatal care have extended to include not only medical aspects of care but also barriers to care, psychological considerations, access to care, and patient education concerning general health, pregnancy, and childbirth (Phelan, 2008). Insufficient prenatal care puts mothers and infants at greater risk for negative outcomes such as preeclampsia (Lain & Roberts, 2002), preterm delivery, low birth weight, and mortality (Friedman, Heneghan & Rosenthal, 2009). Higher quality support during the prenatal period has been linked to a lower

probability of postpartum depression (Collins, Dunkel-Schetter, Lobel, Scrimshaw & Initials, 1993).

### **Factors of Responsible Prenatal Care**

Research supports that the use of vitamins, the number of prenatal visits, and the timing of prenatal care all affect the mother's health during the prenatal period. An appropriate intake of minerals and vitamins during the preconceptional period and pregnancy is pertinent in the reduction of the incidence of adverse perinatal outcomes. This has been more evident in developing countries, predominantly during times of famine, when women suffer from an inadequate intake of minerals and vitamins. However, most women's diets do not meet their increased need for micronutrients even in developed countries. Various micronutrients consolidated in a single multivitamin can prevent some significant obstetric pathologies such as preeclampsia, preterm delivery, and fetal growth restriction (Pelissetto, Zonca, Marozio, Enrietti, & Gheorge, 2009). Research has illustrated that adherence during pregnancy to recommended prenatal multivitamin use is related to women's previous experiences with multivitamin use (Nguyen, Thomas, & Koren, 2009). The use of multivitamins during the prenatal period has been shown to affect both fetal and maternal health and is thus an important aspect of prenatal care to consider in this study.

The Healthy People 2010 initiatives included increasing both the overall percentages of women receiving early and adequate prenatal care and women receiving prenatal care during the first trimester to 90% ("Healthy People 2010"). Early prenatal care is essential in providing education, preventive services, appropriate screening, and treatment of fetal or maternal complications during pregnancy (Denk & Kruse, 2008). In primary care settings, methods have been developed for screening and intervening on harmful consumption of substances. These

methods are targeted towards use for women who are pregnant, planning a pregnancy, or have been identified as being at risk to become pregnant (Floyd, Jack, Cefalo, Atrash, & Mahoney., 2008). Therefore, examining the timing of prenatal care is important in assessing the overall quality of prenatal care received during pregnancy in this study. Although it is related to the timing of prenatal care, the number of prenatal visits is a distinct factor to be considered. Differentiating between initiation and utilization once in care (demonstrated through the number of prenatal visits) is important as they may have differential implications for birth outcomes. Separating these two components allows for the important discrimination between inadequacy of care due to late initiation from inadequacy of care due to an insufficient number of visits (Kotelchuck, 1994). The assumption that an earlier date of initial care results in more adequate prenatal care cannot be assumed as accurate. Therefore, both the initiation of care and the number of visits are separate components should be considered as significant in defining responsible prenatal care. One study examined the association between pregnancy outcomes and reduced prenatal visit frequencies in women who were found to be at low-risk for obstetric complications at the initial prenatal visit. It was illustrated that fewer than 3 prenatal visits was linked to significantly higher incidence of low birth weight babies and prenatal feto-maternal complications compared to those having 7 or more visits (Tasnim, Mahmud & Arif, 2005).

Consequently, it was identified that examining the number of prenatal visits is an important component of determining adequate care during the prenatal period, and therefore will be examined in this study.

## **Prenatal Care and Substance Abuse**

The *Problematic Health Behavior Index* includes items such as late entry into prenatal care, little use of preventive health care, irregular use of prenatal vitamins and substance use as interfering with prenatal health practices (Wakschlag, Pickett, Middlecamp, Walton, & Penny, 2003). In particular, women who do not receive prenatal care have been shown to have a greater likelihood of smoking, using cocaine, and having a prior history of substance abuse. Most women who abuse substances are of reproductive age (ages 15-44) (Velebil, Wingo, Xia, Wilcox, & Peterson, 1995). It has been shown that among women who did not receive prenatal care, the largest percentage noted the primary reason to be problems with substance abuse (Friedman, Heneghan & Rosenthal, 2009). There has been shown to be a high comorbidity of substance abuse and lack of prenatal care (Funkhouser, Butz, Feng, McCaul, & Rosenstein, 1993), and this lack of prenatal care is most often secondary to substance use disorders or denial of pregnancy (Friedman, Heneghan & Rosenthal, 2009). Therefore, substance users have been shown to often enter prenatal care late and early labor and delivery is not unusual (Yonkers, Howell, Allen, Ball & Pantalon, 2009). As a result, obstetric complications and poor pregnancy outcomes among substance users have been linked to lack of appropriate obstetric and neonatal care (Gyarmathy, Giraudon, Hedrich, Montanari & Guarita, 2009; Maupin, Lyman, Fatsis, Prytowiski & Nyugen, 2004 and Wheeler, 1993).

There have been numerous studies documenting that substance-using women, in particular those women who use cocaine or opiates (Schempf & Strobino, 2008), are significantly less likely to obtain prenatal care (Floyd, Jack, Cefalo, Atrash & Mahoney, 2008; Harrison & Sidebottom, 2008; Friedman, Heneghan & Rosenthal, 2009). The reasons that drug-

using women are less likely to obtain care remain unclear. Possible explanations include: surrounding circumstances and chaotic lifestyles; attitudinal or resource barriers to care, such as fear of police report; some disruptive, direct effect of the particular substance; or some combination of these factors. Furthermore, substance use in the preconception period has been used as a predictor of substance use during the prenatal period (Floyd, Jack, Cefalo, Atrash & Mahoney, 2008).

Some studies have found that women who continue to use substances during pregnancy may also engage in other adverse lifestyle behaviors (Huizink, 2009). Along with the frequent concomitant use of tobacco and alcohol and inadequate prenatal care utilization, illicit drug use is also associated with various psychosocial, social, biomedical, and behavioral risk factors (Schempf & Strobino, 2008, Wheeler, 1993). These could include poorer nutrition, less physical activity, and health problems related to substance use habits (such as high blood pressure) (Huizink, 2009). Prenatal drug use has been commonly associated with adverse birth outcomes, yet there is research lacking to identify associated social, psychosocial, behavioral, and biomedical risk factors (Schempf & Strobino, 2008). As a result, this study will examine behavioral factors associated with substance use during pregnancy—particularly in terms of behavioral trends towards prenatal care. Furthermore, recent literature suggests that the frequency of tobacco, alcohol, and licit/illicit drug use can affect the severity of and type of outcomes affecting the child (Huizink & Mulder, 2006). Consequently, this study takes into account the frequency of cigarette, alcohol, and licit/illicit drug use during the prenatal period.

To develop interventions that increase prenatal care for substance-using women, it is necessary to identify barriers to responsible prenatal care in this population. Women who abuse

drugs during pregnancy often remain unidentified to researchers and practitioners in many cases and, for this reason, have not been well studied. There seems to be an overall lack of research concerning the various behavioral and psychosocial factors relating to birth mothers and substance abuse, although the adverse outcomes on the children have been well established. Therefore, the current study will examine aspects of responsibility towards prenatal care in relation to drug use during pregnancy.

### **Treatment/Intervention**

Research has clearly illustrated that substance abuse poses significant health risks to women of child-bearing age. Alcohol is the most prevalent substance consumed by child-bearing aged women, followed by tobacco and a variety of illicit drugs. A substantial proportion of childbearing-aged women have been shown to consume one or more of these substances, increasing their risks for adverse health outcomes, and if pregnant, adverse pregnancy outcomes (Floyd, Jack, Cefalo, Atrash & Mahoney, 2008). As a result of substance use during pregnancy, it has been shown that later in childhood, behavioral and cognitive problems may arise (Gyarmathy, Giraudon, Hedrich, Montanari & Guarita, 2009). The leading preventable cause of birth defects and developmental disabilities has been attributed to prenatal alcohol use. In addition to research specifically pertaining to prenatal alcohol use, many demographic and socioeconomic factors associated with smoking during pregnancy have been established (Wakschlag, Pickett, Middlecamp, Walton, & Penny, 2003). However, little is known about behavioral factors that are associated with smoking, as well as other substance use, during pregnancy.

There is still substantial substance abuse among pregnant women in the U.S. despite the information received by the general public on the negative effects of substance abuse during pregnancy (Ananth, Oyelese, Yeo, Pradhan, & Vintzileos, 2005). It is recommended by health professionals that alcohol and nonmedical use of drugs are abstained from during pregnancy due to suspected and confirmed links to poor birth outcomes and maternal health (Harrison & Sidebottom, 2008). Those pregnant women who are identified as substance users by medical providers are often those exhibiting concern raising behavior with health providers—such as presenting for labor having had no prenatal care.

It has been illustrated that birth mothers using tobacco, alcohol, or licit/illicit drugs who receive intervention early in pregnancy (resulting in a decrease or cessation in the behavior) reduce their risks of adverse birth outcomes (Cambell & Murphy, 2009; Hjerkin, Rossvold & Lindbaek, 2009; Friedman, Heneghan, & Rosenthal, 2009). Furthermore, substance abuse treatment integrated with prenatal visits has been associated with a positive effect on maternal and newborn health (Goler, Armstrong, Taillac & Osejo, 2008). Therefore, women who are pregnant or at risk for becoming pregnant are a high priority for interventions to reduce drug use (Sywenki & Lipinska-Gediga, 2009).

The importance of identifying behavioral factors associated with birth mother substance abuse arises from recent literature suggesting that early intervention and prevention is effective in avoiding adverse birth outcomes. My thesis focuses primarily on those constructs involving substance use and prenatal exposure to drugs. The objective of my thesis is to examine the relation between the aspects of responsibility (defined as timing of first prenatal care visit, number of prenatal visits, and use of prenatal multivitamins) towards prenatal care and the

severity of drug substance (severity of risk of drug, frequency of drug use, and number of drugs used) used during pregnancy. The research question being examined is: Is there a relation between responsibility toward prenatal care and severity of drug use during pregnancy? The rationale for conducting this work is that although there has been much research conducted to study to the adverse outcomes of prenatal drug use, there is a lack of research examining the prenatal care risk factors and trends in regard to drug use. Since prenatal care involving early intervention and treatment for pregnant substance-users has been shown to improve fetal outcomes, this research focusing on responsibility towards prenatal care and substance use deems itself to be useful in prevention.

The hypothesis of this study was that birth mothers who displayed less responsible maternal prenatal care habits would be more likely to use substances during pregnancy. Furthermore, severity of substance use was predicted to be higher for mothers displaying less responsible maternal prenatal habits. By examining this relationship, risk factors for poor prenatal care can be identified and targeted by service providers working with substance using and non-using women.

## **Method**

### **Sample**

Data were derived from the Early Growth and Development Study, an ongoing, longitudinal multi-site study of birth parents, adopted children, and adoptive families. The prospective adoption study was designed to examine specific features of family relationships that moderate or mediate the expression of genetic influences as they appear in infancy and unfold

later in development. There were three recruitment sites: mid-Atlantic, West/Southwest, and Pacific Northwest. Thirty-three agencies in 10 states, reflecting public, private, religious, secular, those favoring more open adoptions, and those favoring more closed adoptions, participated in the study. Data collection was initiated in Spring 2003 and completed in Spring 2006. This particular study focuses exclusively on examining the cohort of birth mothers (N=554) who completed adoption plans for their infants. The mean age for the birth mothers was 23.83 years. Seventy-eight percent of the birth mothers were Caucasian, 10% were African-American, 2% were Asian, 5% were multi-ethnic, and 5% were other. The mean educational level was completion of trade school, and mean annual household income was less than \$20,000. The mean number of individuals in the birth mothers' homes was 3.6 individuals (Leve, Neiderhiser, Ge, Scaramella & Conger, 2007).

## **Procedures**

Birth parents were interviewed twice, at approximately 3 and 18 months postpartum. Data were collected at 3-months post-partum from a self-report pregnancy screener and a Pregnancy History Calendar (PHC), which was modified from the original Life History Calendar (LHC; Caspi, Moffitt, Thornton, Freedman & Amell, 1996). Modifications to the LHC for the Early Growth and Development Study included focusing specifically on behaviors (including those related to substance use) during pregnancy. The Life History Calendar method emphasizes patterns of behavior rather than frequencies at single points in time. The participant and interviewer developed a calendar in which significant life events and activities during pregnancy were indicated by interval or trimester. The participants were asked to reflect on substance abuse behaviors that occurred during each period, using the significant events to aid in recall. Birth

mothers answered questions about their use of alcohol, tobacco, licit and illicit drugs and other behaviors during pregnancy using a *Computer Assisted Personal Interviewing* (CAPI) with the help of a trained interviewer and the PHC. The CAPI method ensured privacy and anonymity of the subjects. The items used in this study can be found in Appendix 1.

## **Measures**

### *The Pregnancy History Calendar.*

Data on severity and frequency of drug use during the 9-month prenatal period were collected using an 18-item self-report pregnancy history calendar, adapted from the Life History Calendar method (see above for description of procedure; Caspi, Moffitt, Thornton, Freedman & Amell, 1996). The substances examined in this study included: tobacco, alcohol, and a comprehensive category of licit and illicit drugs (including sedatives, tranquilizers, amphetamines, prescription painkillers, inhalants, marijuana, cocaine, hallucinogens, and heroin). For this study, the use of these substances was considered during the nine month prenatal period. Two factors were considered concerning drug use: (1) Whether the particular substance was used during pregnancy and (2) Frequency of substance use. Questions were open ended [examples include: “What brand of cigarettes did you smoke during this first interval? (Please be as specific as possible, e.g. Marlboro Ultra Lights or Virginia Slims Super Slim Menthols),” and, “What types of drink(s) did you have? (type of beer, wine, hard liquor, etc ...)” ] multiple choice (examples include: “During these nine months, did you drink alcohol?” with answer choices “1.Yes” and “2.No” and “How frequently did you drink alcohol during these nine months?” with answer choices “1.Rarely, 1 to 6 times, during these nine months,”

“2. Infrequently, about once a month,” “3. Somewhat regularly, once or twice a week,” and “4. Regularly, most days of the week or everyday”).

*Pregnancy Screener.*

The aspects of responsibility towards prenatal care were defined through the following constructs: number of prenatal visits and use of prenatal vitamins. These variables were chosen due to their determined significance as per the literature (Pelissetto, Zonca, Marozio, Enrietti, & Gheorge, 2009; Tasnim, Mahmud, & Arif, 2005). A 34-item self-report pregnancy screener was developed for the current study in order to obtain information about pregnancy events including prenatal health care, illness during pregnancy, the birth, and current health status. Questions included were both open-ended (i.e., “When did you FIRST visit the doctor for a pregnancy related visit (prenatal visit)?” with answers entered in month/day/year format and “How many times did you visit the doctor for health care related to your pregnancy?” with answers entered in numerical form) and multiple choice (i.e., “How frequently did you take your multi-vitamins or prenatal vitamins during your pregnancy?” or “How frequently did you take a separate iron pill?” with answer choices “1=not at all,” “2=rarely, only a few times during my pregnancy,” “3=occasionally, 1-2 times a month,” “4=fairly regularly, 1-2 times a week,” “5=regularly, 3-4 times a week,” “6=very consistently, almost everyday”). The use of prenatal vitamins was considered for the entire 9-month prenatal period.

*Demographic Recruitment Form.*

Demographic information relating to the variables of race, age and education were obtained from the demographic recruitment form. The form included specific questions specifically pertaining to the adoptive parents, the birth mother, and the birth father. Questions

included both open-ended (i.e. “Birth Father Age” with blanks to specify the particular information) and multiple choice (i.e. “Sex of Same Parents” with answer choices “1. Male or 2. Female”). The forms were completed by the adoption agencies, and reviewed by the recruitment team for obvious errors.

### **Data Reduction**

Composites variables were created to reflect frequency and severity of substance use during pregnancy. Illicit/illegal drugs (included sedatives, tranquilizers, amphetamines, prescription painkillers, inhalants, marijuana, cocaine, hallucinogens, and heroin) were collapsed. Drug use variables were created to describe any use during pregnancy and serious use during pregnancy. “Any Use” variables meant any use at all during pregnancy. “Serious Use” variables for tobacco represented 10 or more cigarettes a day (standard criterion used in the field); for alcohol they represented use at least once a week; for other drugs they represented use at least once a week. One overall variable was created for responsibility. The variables for number of prenatal visits and use of vitamins were combined since they were both conceptually and statistically correlated ( $r = .32, p < .01$ ). Z-scores were taken for both variables and combined to create the “Overall Responsibility” variable.

## **Results**

### **Descriptive Statistics and Correlations**

All analyses were performed using SPSS for Windows. Descriptive statistics can be found in Table 1. Skewness and kurtosis were examined for all variables. Square-root transformations were performed on skewed variables, bringing skewness and kurtosis statistics

as close as possible to the acceptable range. Due to the high frequency of zeros in the data, log or natural log transformations were not used. After square-root transformations, some variables were still skewed: “Pregnancy Any Use” (kurtosis= -1.85); “Pregnancy Frequency of Any Use of Alcohol” (skewness=1.78 and kurtosis=2.80); “Pregnancy Serious Use of Alcohol” (skewness=3.68 and kurtosis=11.60); “Pregnancy Serious Use of Tobacco” (skewness=1.26); “Pregnancy Serious Use of Drugs” (skewness=2.07 and kurtosis=2.30); and “Pregnancy Serious Use” (kurtosis= -1.672). The high skewness values suggest that there is a lack of symmetry in the data while the high kurtosis values suggest that the data have a distinct peak near the mean and decline rather rapidly. Birth mother age and highest level of education attained were correlated with some independent variables (see Table 1), and as a result, they were included as controls in the regression analyses.

Bivariate Pearson correlations were run to examine relation among variables of interest and can be found in Table 2. As expected, many of the demographic variables were related to one another as were the substance use variables (Table 2). Relevant to the current study, some factors of maternal responsibility towards prenatal care were related to substance use. A significant negative correlation was shown between the number of prenatal visits and frequency of prenatal alcohol use. There were significant negative correlations for frequency of use of prenatal vitamins and prenatal any use of substances, prenatal serious use of tobacco, and prenatal serious use. Significant negative correlations were also found for overall maternal responsibility towards prenatal care and prenatal serious use of tobacco, and prenatal serious use. There was a marginally significant correlation between overall maternal responsibility towards prenatal care and frequency of prenatal alcohol use.

## Hierarchical Multiple Regression Analyses

To further explore the relative contributions of substance use on frequency of prenatal vitamin use, a hierarchical multiple regression analysis was conducted. Prenatal vitamins were analyzed as an outcome (instead of the number of prenatal visits or the overall responsibility composite variable) due to the high number of significant correlations illustrated with this particular variable (Table 2). Regressions were run based on which correlations were shown to be related. Three separate regressions were run because data was conflated (certain variables of interest had data that overlapped, for example serious prenatal substance use and serious prenatal tobacco use). Results are presented in Tables 3-5. In addition to incorporating the key variables of interest, the final models controlled for the demographic variables birth mother age and birth mother highest level of education attained (Answer choices for this question were as follows: 1. less than 8th grade, 2. completed 8th grade, 3. completed 12th grade, 4. some trade school, 5. completed trade school, 6. some junior college, 7. completed junior college, 8. some college, 9. completed college, 10. some prof. or grad. school, 11. completed prof. or grad. school, 12. other), as these variables may have an impact on relations of interest. These two covariates were entered in the first step of the model. The last step of the model was the substance use variable relevant to the frequency of use of multivitamins.

Frequency of prenatal vitamin use was predicted by any prenatal substance use ( $\beta = -.11$ ,  $p < .05$ ; full model  $R^2 = .03$ , Cohen's  $f^2 = .03$ ) (Table 3), by serious prenatal substance use ( $\beta = -.14$ ,  $p < .01$ ; full model  $R^2 = .03$ , Cohen's  $f^2 = .03$ ) (Table 4), and by Prenatal serious use of tobacco ( $\beta = -.16$ ,  $p < .01$ ; full model  $R^2 = .04$ , Cohen's  $f^2 = .04$ ) (Table 5).

## Discussion

Previous studies have found that women who continue to use substances during pregnancy may also exhibit other adverse lifestyle behaviors (Huizink, 2009). Prenatal drug use has been commonly associated with adverse birth outcomes. However, research was lacking to identify associated social, psychosocial, behavioral, and biomedical risk factors (Schempf & Strobino, 2008). The current study examined behavioral factors associated with substance use during pregnancy—particularly in terms of behavioral trends towards prenatal care. The relationship between responsible maternal prenatal care and substance use was examined. In this study, responsible maternal prenatal care was defined as number of prenatal visits and use of vitamins. It was expected that birth mothers who displayed less responsible maternal prenatal habits would be more likely to use substances during pregnancy. Furthermore, severity of substance use was also predicted to be higher for those mothers displaying less responsible maternal prenatal habits.

The expectation that birth mothers displaying less responsible maternal prenatal care habits would be more likely to use substances during pregnancy was supported. It was illustrated that the frequency of prenatal vitamins was significantly predicted by any prenatal substance use, prenatal serious use of tobacco, and prenatal serious use. The current findings are consistent with the previous research showing that substance use is also associated with various psychosocial, social, biomedical and behavioral risk factors (Schempf & Strobino, 2008, Wheeler, 1993). These have been found to include poorer nutrition, health problems related to substance use habits (such as high blood pressure), less physical activity (Huizink, 2009)—and now due to the current study, less responsible maternal prenatal care habits.

The current study also predicted that the severity of substance use (frequency) would be higher for those mothers displaying less responsible maternal prenatal habits. This hypothesis was also supported. There was shown to be a significant negative relationship between the number of prenatal visits and frequency of prenatal alcohol use. There was a marginally significant correlation displayed between overall maternal responsibility towards prenatal care and frequency of prenatal alcohol use. This is consistent with the recent literature suggesting that the frequency of tobacco, alcohol, and licit/illicit drug use can affect the severity of and type of outcomes affecting the child (Huizink & Mulder, 2006). In this study it was illustrated that the frequency of substance use can affect the maternal responsibility towards prenatal care.

It was interesting to note that use of prenatal vitamins had more significant correlations than did the number of prenatal visits (see Table 2). This seems to suggest that prenatal vitamins may serve as a better indicator of maternal responsibility towards prenatal care than does the number of prenatal visits. Research has displayed that adherence during pregnancy to recommended prenatal multivitamin use is related to women's previous experiences with multivitamin use (Nguyen, Thomas, & Koren, 2009). This suggests that those women who utilized prenatal vitamins during pregnancy may have had previous experience with multivitamin use prior to pregnancy. It could be suggested that adherence to prenatal vitamin use is a more regular prenatal behavior in comparison to prenatal visits—and perhaps a better indicator of more responsible prenatal care. Mothers who do not use vitamins regularly before pregnancy could be considered at greater risk for less responsible prenatal care habits during pregnancy, and health care providers should pay particular attention to pre-pregnancy health habits.

It is also important to consider that the number of prenatal visits will vary depending on the duration of the pregnancy. If the baby was premature (36 week's gestation or less), the number of prenatal visits could be lower (Kotelchuck, 1994). However, this would not necessarily mean that less maternal responsibility was demonstrated. This could be another reason that adherence to prenatal vitamin use may have been a better indicator of more responsible prenatal care. This also suggests that in future studies examining the number of prenatal visits as an indicator of responsible care should use gestational age as a control variable.

### **Limitations and Future Research**

The current study used a self-report pregnancy screener and a Pregnancy History Calendar (PHC) for data collection. Due to the prevalence of substance use in pregnant women, the most effective methods to identify neonate substance exposure have been extensively studied. Maternal self-report of drug use seems to be the most practical and inexpensive method that allows assessment of the details of substance use (including frequency and quantity changes over time). However, the accuracy of this self-report method has not always been illustrated as high. Limitations of the self-report have been included a tendency of users to diminish or deny use due to the fear of consequences or some sense of associated guilt. There have been several studies to demonstrate that accuracy of the self-report method can be improved by ensuring confidentiality and privacy, using experienced staff who can establish rapport, and utilizing prompts (such as calendars) to provide memory cues (Eyler, FD., Behnke, M., Wobie, K., Garvan, C.W., & Tebbett, I.,2005). This method was used in this study through the use of CAPI, trained interviewers, and the Pregnancy History Calendar.

One study examining the ability of biologic specimens and interviews to detect prenatal cocaine use concluded that daily collection and testing of during throughout the pregnancy would likely be the only way to ensure detection of prenatal drug use ((Eyler, Behnke, Wobie, Garvan, & Tebbett, 2005). However, this seems neither feasible nor practical information to obtain for the current study. Blinded urine toxicology screens have been shown to give the most objective picture of women who use drugs during pregnancy (Hans, 1999). It has been demonstrated that the convergent validity of the urine test and self-report of drug use seems to be quite satisfactory (Basurto, Montes, Cubos, Santed, & Ríos, 2009). However, measuring levels and patterns of substance use and associated behaviors has been shown to require the use of self-report methods (Harrison & Hughes, 1997). Therefore, in future studies, it would be ideal to self-report data in combination with medical records data (including urine test data) to obtain the most accurate and complete data concerning substance use during pregnancy.

The current study examined the number of prenatal visits as a component of responsible maternal prenatal care. However, timing of prenatal care (which was not examined in this study) has been identified as a distinct, yet related, component to number of prenatal visits. Differentiating between initiation (timing of prenatal care) and utilization once in care (demonstrated through the number of prenatal visits) is important as they may have differential implications for birth outcomes. Separating these two components allows for the important discrimination between inadequacy of care due to late initiation from inadequacy of care due to an inadequate number of prenatal visits (Kotelchuck, 1994). The assumption that an earlier date of initial care results in more sufficient prenatal care cannot be assumed as correct. Therefore, both the initiation of care and the number of visits are separate components should be considered as significant in defining responsible prenatal care. In future studies, it would be ideal to

examine both components. However, the number of prenatal visits examined in the current study provided pertinent information to the study.

## **Conclusions**

This study provides important information in regard to the relationship between responsible maternal prenatal care and substance use during pregnancy. The information found in this study contributes to elucidating adverse behavioral factors that may be found in substance using mothers—an area of research that is currently lacking. This study represents an important early step in understanding the effects of substance use on the mother's habits during pregnancy. The importance of identifying behavioral factors correlated with birth mother substance abuse arises from recent literature suggesting that early intervention and prevention is effective in avoiding adverse birth outcomes (Cambell & Murphy, 2009; Hjerkin, Rossvold & Lindbaek, 2009; Friedman, Heneghan, & Rosenthal, 2009). Continuing research of this kind will further the understanding of the habits and behaviors of the cohort of substance use mothers, and may help promote more responsible prenatal habits in this cohort in the future through early detection, intervention and prevention.

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## Appendix 1: Items from Pregnancy History Calendar and Pregnancy Screener

### *Pregnancy History Calendar.*

1. How frequently did you visit the doctor during these nine months?
2. During these nine months, did you take vitamins?
3. During these nine months, did you smoke cigarettes?
4. During these nine months, did you drink alcohol?
5. During these nine months, did you use Sedatives (e.g. medicine to help you relax or sleep)?
6. During these nine months, did you use Tranquilizers?
7. During these nine months, did you use Amphetamines?
8. During these nine months, did you use Prescription Painkillers?
9. During these nine months, did you use Inhalants?
10. During these nine months, did you use Marijuana?
11. During these nine months, did you use Cocaine?
12. During these nine months, did you use Hallucinogens?
13. During these nine months, did you use Heroin?
14. How frequently did you drink alcohol during these nine months?
15. How frequently did you use Sedatives during these nine months?
16. How frequently did you use Tranquilizers during these nine months?
17. How frequently did you use Amphetamines during these nine months?
18. How frequently did you use Prescription Painkillers during these nine months?
19. How frequently did you use Inhalants during these nine months?
20. How frequently did you use Marijuana during these nine months?
21. How frequently did you use Cocaine during these nine months?
22. How frequently did you use Hallucinogens during these nine months?
23. How frequently did you use Heroin during these nine months?
24. What was the average number of cigarettes you smoked per day during this first interval?
25. What was the average number of cigarettes you smoked per day during this second interval?
26. What was the average number of cigarettes you smoked per day during this third interval?

### *Pregnancy Screener.*

1. When did you FIRST visit the doctor for a pregnancy related visit (prenatal visit)?
2. How many times did you visit the doctor for health care related to your pregnancy?
3. How frequently did you take multi-vitamins or prenatal vitamins during your pregnancy?
4. How frequently did you take a separate iron pill?

Table 1.

*Descriptive Statistics of Prenatal Care and Substance Use Variables*

	N	Minimum	Maximum	Mean	Std. Deviation
Number of Prenatal Visits	507	0	50	10.71	7.83
Frequency of Vitamin Use	524	1	6	4.41	1.94
Overall Responsibility	525	-1.76	2.92	.00	.80
Pregnancy Any Use	483	0	1	.60	.49
Frequency of use of Alcohol	483	0	9	.36	.88
Pregnancy Serious Use of Alcohol	492	0	1	.06	.24
Pregnancy Serious Use of Tobacco	454	0	1	.23	.42
Pregnancy Serious Use of Drugs	483	0	1	.14	.35
Pregnancy Serious Use	440	0	1	.36	.48

Table 2. *Correlations Among Key Prenatal Care and Substance Use Variables*

	Number of Prenatal Visits	Frequency Vitamin Use	Overall Responsibility	Pregnancy Any Use	Frequency of Any Alcohol Use	Pregnancy Serious Use of Alcohol	Pregnancy Serious Use of Tobacco	Pregnancy Serious Use of Drugs	Pregnancy Serious Use	BM Age	BM Highest Education
Number of Prenatal Visits	.32	.80		-.02	<b>-.10*</b>	-.07	-.04	.02	-.07	-.06	-.01
Frequency of Vitamin Use		.80		<b>-.10*</b>	-.06	.02	<b>-.14**</b>	-.03	<b>-.12*</b>	-.06	<b>.10*</b>
Overall Responsibility				-.07	-.09†	-.04	<b>-.11*</b>	-.02	<b>-.12*</b>	-.07	.05
Pregnancy Any Use					.44	.21	.52	.33	.67	<b>.16**</b>	.03
Pregnancy Frequency of Any Alcohol Use						.66	.14	.18	.40	.02	<b>.11*</b>
Pregnancy Serious Use of Alcohol							.01	.17	.36	.09	<b>.12**</b>
Pregnancy Serious Use of Tobacco								.29	.80	<b>.17**</b>	-.09 †
Pregnancy Serious Use of Drugs									.57	<b>.13**</b>	.02
Pregnancy Serious Use										<b>.22**</b>	.01
BM Age											<b>.31**</b>

\*  $p < .05$ ; \*\* $p < .01$ ; †  $p < .10$ ;  $N$ 's ranged from 381 to 525 depending on the measures examined

Table 3

*Hierarchical Regression Model Examining the Relation Between Any Prenatal Substance Use and Frequency of Prenatal Vitamin Use*

Variable	Step 1	Step 2
	$\beta$	$\beta$
Age of Birth Mother	-.10†	-.08
Birth Mother Highest Education Attained	.10*	.10*
Any Prenatal Substance Use		-.11*

Note: All  $\beta$ s are standardized.

Final step model,  $F(3,411) = 3.50^*$ ,  $R^2 = .03$ ; Adj  $R^2 = .02$ , Cohen's  $f^2 = .03$

$\Delta R^2$  in Step 2 = .01

\* $p < .05$ ; \*\* $p < .01$ ; †  $p < .10$

Table 4

*Hierarchical Regression Model Examining the Relation Between Serious Prenatal Substance Use and Frequency of Vitamin Use*

Variable	Step 1	Step 2
	$\beta$	$\beta$
Age of Birth Mother	-.07	-.04
Birth Mother Highest Education Attained	.12*	.12*
Any Serious Prenatal Substance Use		-.14**

Note: All  $\beta$ s are standardized.

Final step model,  $F(3,372) = 4.24^{**}$ ,  $R^2 = .03$ ; Adj  $R^2 = .03$ , Cohen's  $f^2 = .03$

$\Delta R^2$  in Step 2 = .02

\* $p < .05$ ; \*\* $p < .01$ ; †  $p < .10$

Table 5

*Hierarchical Regression Model Examining the Relation Between Serious Prenatal Tobacco Use and Frequency of Prenatal Vitamin Use*

Variable	Step 1	Step 2
	$\beta$	$\beta$
Age of Birth Mother	-.08	-.05
Birth Mother Highest Education Attained	.11*	.09
Serious Prenatal Tobacco Use		-.16**

Note: All  $\beta$ s are standardized.

Final step model,  $F(3,385) = 4.77^{**}$ ,  $R^2 = .04$ ; Adj  $R^2 = .03$ , Cohen's  $f^2 = .04$

$\Delta R^2$  in Step 2 = .02

\* $p < .05$ ; \*\* $p < .01$ ; †  $p < .10$

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## Academic Vita of Nikita Nagpal

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Name: Nikita Nagpal

E-Mail ID: [nzn5004@psu.edu](mailto:nzn5004@psu.edu)

### Education

- Major: B.S., Biology (Neuroscience option)
- Honors: Biology

Thesis Title: STUDYING THE RELATIONSHIP BETWEEN QUALITY OF PRENATAL CARE AND SUBSTANCE USE IN BIRTH MOTHERS

Thesis Supervisor: Dr. Jenae Neiderhiser

### Work Experience

- *Seasonal Sales Associate*  
December 2006 to January 2007  
As a seasonal sales associate, my responsibilities included greeting customers, aiding customers throughout the store, keeping track of merchandise inventory, and working at the register.  
Bath & Body Works (Muncy, PA)
- *Research Assistant*  
August 2007 to May 2008  
The primary goal of the Family Life Project is to learn about how differences in children's development are linked to variations in temperament, family experience, community structure, economic circumstances, and ethnicity. I worked on Project I-Temperament, Psychobiological, and Cognitive Predictors of Competence among Children in Poor Rural Communities. As a student research assistant, my responsibility was to code specific behavioral markers of stress during particular tasks performed by children.  
Human Development & Family Studies Lab (State College, PA)  
Dr. Cynthia Stifter
- *Summer Research Intern*  
June 2008 to August 2008  
I worked full-time in Dr. Mansoor Ahmed's research lab, which focused on emerging therapies for brain cancer. My particular research topic involved studying the efficacy of low-dose fractionated radiation in potentiating Temozolomide in three brain cancer cell lines. I was responsible for conducting an independent experiment to test the hypotheses that low-dose fractionated radiation therapy in addition to Temozolomide would be a

more effective treatment than the standard high dose radiation. In the course of my experiment I gained skill and familiarity with scientific techniques such as cell culture techniques, western blot, x-ray irradiation, gel electrophoresis, RNA isolation, cell cycle distribution, and colony formation.

Geisinger: Weis Center for Research (Danville, PA)

Dr. Mansoor Ahmed

- *Research Assistant*

August 2008 to Present

The Early Growth and Development Study is a longitudinal study of adopted children, their adoptive parents, and birth parents aimed at understanding how children and their families influence each other. My role involves coding prenatal medical records containing all of the information about the birth mother's medical history, previous pregnancies, and the current pregnancy, with the goal of collecting pertinent information to establish a database of information for the study.

Psychology Lab (State College, PA)

Dr. Jenae Neiderhiser

Grants Received [*whether from Schreyer Honors College (e.g., Schreyer Ambassador awards) or from other sources; please specify*]:

Schreyer Honors College Travel Grant

Awards:

- Dean's List

Professional Memberships:

- Alpha Epsilon Delta
- Vice President of Vision Education for Penn State Chapter of Unite for Sight

Community Service Involvement:

- *Susquehanna Health System VolunTEEN/Volunteer*

May 2003-August 2008

As a volunteer, I greeted, guided, visited, and talked with patients. I also organized weekly activities in the Skilled Nursing Unit, helped start a new volunteer program on the Acute Medical/Surgical Floor, observed medical and procedures in the Emergency room and a Physician's office, and carried specimens to the laboratory.

- *SouthernCare Hospice Volunteer*

June 2007-August 2008

I visited hospice patient to talk, read, run errand. I additionally performed secretarial work in the SouthernCare office.

- *Global Medical Brigades*  
August 2008 to Present  
I participated in a week-long medical brigade in Honduras in January 2009. I also participated in fundraising events to raise money and procure medications for the brigades.
- *Alpha Epsilon Delta*  
April 2008 to Present  
As a member of this Pre-Medical honor society, I have participated in THON and the Public Health Fair at Penn State.
- *Unite for Sight*  
June 2009 to Present  
Serving as Vice President of Vision Education, I plan and implement vision education events in the local State College community as well as at Penn State University. I also helped raise money to fund eye surgeries abroad.

Language Proficiency:

- Spanish
- Hindi