Prenatal depressive symptoms and social support: An examination of their roles in prenatal care adequacy, birth outcomes, and postpartum depressive symptoms among low-income urban women

A DISSERTATION
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL OF THE UNIVERSITY OF MINNESOTA
BY

Abbey Chapman Sidebottom

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

Wendy L. Hellerstedt, PhD., MPH, Advisor

April 2016

Acknowledgments

There are several people who have been important in my pat toward completing this degree. Wendy Hellerstedt, my advisor, has provided mentorship at each step of this dissertation process. She is distinguished by both her renowned expertise as maternal and child health researcher and by her exceptional teaching skills. I am grateful to have had the opportunity to work with Wendy as a mentee and as a collaborator. I am grateful to her for her valuable insight and guidance in all areas of this research work, and for challenging me and helping me grow as a researcher, not to mention the many hours spent reading drafts. I learned many lessons from Wendy in this process that will improve my work throughout my career. I am grateful for her patience and support as I conducted this work in combination with many other life demands.

I am grateful to my committee members: Kathleen Call, Deborah Hennrikus, and Rhonda Jones-Webb. As a group they bring varied expertise and perspectives that contributed to the theoretical framework, analysis, and writing of these papers. I am also appreciative of those who made it possible for me to work with these data sets: Pat Harrison at the Minneapolis Department of Health, Judy Palermo at the Minnesota Department of Health for her work to link Healthy Start data with birth certificate data, and especially, the women who are represented in these data.

I pursued this degree while of working in public health research. I am so grateful for the amazing jobs, managers, and co-workers I have had during this time period. Pat Harrison, my supervisor at the Minneapolis Department of Health, provided inspiration and the

opportunity to grow my skills as a researcher. I admire her drive to improve the health of others through research. As the developer of the screening tool used throughout this dissertation, Pat opened up a line of research to improve the systematic screening for psychosocial risks among pregnant women. I am grateful to have been a part of this research and work with Pat as a co-author. Heather Britt hired me to join Allina's Division of Applied Research providing the opportunity for many new research experiences. I am glad to be a part of her vision for the integration of research with health care improve the health of communities we serve. I am grateful that she has provided the flexibility to balance school and work, for her encouragement, and for her continued friendship. There are many other co-workers and friends who have been supportive through this process. Thank you to Beth Gyllstrom, Lori Boland, Pam Mink, Pamela Johnson, Ellie Zuehlke, Leah Goldstein Moses, Jenny Bordon, Julie Erickson, Kate Goeddeke, Meg Hoyt-Niemiec, Jennifer May, Jane Onsrud, and Laura Stokes.

I am grateful to my mom and dad who gave me the gifts of an amazing college education and opportunities to explore the world and identify a career field that makes me happy. I am grateful for your enduring support. I am also appreciative of the patience and support my two smart and kind daughters, Corinne and Margaret, through this process.

I am beyond grateful for my husband, Warren Zacher, and his steadfast support of me at various stages of this degree. For encouraging me to continue my education, for taking on more parenting when needed, and for believing in me I am forever grateful. I could never have done this without you.

Abstract

Objectives. This project aimed to examine associations of two key psychosocial factors, social support and depressive symptoms, with prenatal care attendance and poor birth outcomes (i.e., preterm birth, low birthweight, and small for gestational age), in a racially diverse, urban low-income sample. Whether or not social support modifies the association of depressive symptoms with prenatal care and birth outcomes is also examined. This project also aimed to examine the associations of prenatal and postpartum depressive symptoms, characterizing the timing of detection and persistence or recurrence of symptoms. Personal, behavioral, and environmental correlates of experiencing elevated depressive symptom levels in pregnancy only, postpartum only, or during both periods were identified.

Methods. This dissertation includes three secondary data analyses. Data for these studies come from risk screening tools (Prenatal and Postpartum Risk Overview) used by community based clinics as part of the Twin Cities Health Start program and from linked birth certificates. The Prenatal Risk Overview (Appendix A) is a standardized interview conducted with all women entering prenatal care at these clinics, and a smaller set of questions is conducted at postpartum. The PRO screens for depression, social support as well as other social, behavioral, and environmental risks. The study samples for each paper comes from the set of 3,380 women who started prenatal care at five community health centers affiliated with TCHS between 2005 and 2009 and completed the prenatal intake risk assessment. For the first manuscript, examining prenatal care, the sample was limited to those with a live born infant and a matched birth certificate with available data

on prenatal care attendance (n = 2,341). For the second manuscript, examining birth outcomes, the sample was limited to those with a live born infant and a matched birth certificate with complete birth outcomes data (n = 2,868). For the third manuscript, examining prenatal and postpartum depressive symptoms, the sample was limited to those who had enrolled in the TCHS program and completed a postpartum risk screen within the specified time period (n = 594).

In the first manuscript, the dependent variables were late prenatal care and less than adequate prenatal care with prenatal depressive symptoms and social support as the independent variables. In the second manuscript, preterm birth, low birthweight, and small size for gestational age were the dependent variables with prenatal depressive symptoms and social support as the independent variables. A comprehensive set of covariates including personal, social, behavioral environmental risks are included in each of these papers. In the third manuscript, the association between elevated depressive symptoms in the prenatal and postpartum periods are explored. The dependent variables were elevated depressive symptoms at different time points (in pregnancy only, postpartum only, or during both periods) compared to low symptoms at both time periods. Analysis identified personal, behavioral, and environmental risk factors for each pattern of depressive symptoms.

Results. In the first manuscript, examining prenatal care, an interaction was identified for partner support and depressive symptoms with regard to late prenatal care. Specifically, women with both no/low partner support and elevated depressive symptoms were at highest risk of late care (AOR 1.85, 95% CI: 1.31, 2.60) compared to women with both

good partner support and low depressive symptoms. Those with good partner support and elevated depressive symptoms were less likely to have late care (AOR 0.74, 95% CI: 0.54, 1.01). Lack of social support was a risk for prenatal care inadequacy while depressive symptoms were not. Women with moderate/poor social support were more likely (AOR 1.29, 95% CI: 1.05, 1.60) to get less than adequate care compared to women with good support. Women with moderate/high depressive symptoms were less likely to experience less than adequate care compared to women with low symptoms (AOR 0.73, 95% CI: 0.56, 0.96).

In the second manuscript, examining birth outcomes, depressive symptoms were weakly associated with LBW in unadjusted analyses, but the association did not persist in multivariable analyses. Similarly, partner support was associated with LBW and SGA—and friend support was associated with LBW—in unadjusted analyses only. Depressive symptoms and support variables were not associated with PTB.

In the third manuscript, we identified that more women had elevated depressive symptoms prenatally (23%) than in the postpartum period (14%). In our sample, 15% had depressive symptoms in the prenatal period only, 8% had depressive symptoms in both periods, and 6% in the postpartum period only. Of women with postpartum elevated depressive symptom levels, 58% had elevated levels in the prenatal period. All of the social, behavioral, and environmental risks examined were significantly associated with elevated depressive symptoms at any point compared to women with low depressive symptoms at both points. Risk factors varied for those who experienced depressive

symptoms at one point versus those with persistent depressive symptoms. Lack of social support, being foreign born, and food insecurity were risk factors for experiencing depressive symptoms in the prenatal period, while abuse, not living with the father of the baby, and smoking were associated with risk of elevated depressive symptoms in both periods. Limited phone access, possibly a measure of social isolation or extreme poverty, was a risk for experiencing depressive symptoms only in the postpartum period.

Conclusion.

The collective findings of these three manuscripts exploring social support and depressive symptoms indicate that screening for poor social support and elevated depressive symptoms early in pregnancy or in preconception periods may be helpful for identifying risks related to prenatal care attendance as well as postpartum depressive symptoms in low-income urban populations, but did not identify either of these as independent risk factors for LBW, PTB, or SGA in the study population. Findings related to depressive symptoms also indicate that including screening for a set of personal, behavioral, and environmental risk factors may identify women at increased risk of depressive symptoms during pregnancy and/or the postpartum period.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

ACOG – American College of Obstetricians and Gynecologists.

AOR – Adjusted Odds Ratio

APNCU – Adequacy of Prenatal Care Utilization Index. Developed by Milton Kotelchuck and also referred to as the Kotelchuck index. The measure takes into account gestational age at delivery, timing prenatal care began and number of visits.

BMI – Body Mass Index

CPS - Child Protection Services

FQHC – Federally Qualified Health Center

LBW – Low Birthweight. Infants weighing less than 2500 grams (the equivalent of about 5.5 lbs) are low birthweight.

NHSDUH – National Household Survey on Drug Use and Health

OR – Odds Ratio

PHQ-9 – Patient Health Questionnaire. A depression screening instrument.

PRO – Prenatal Risk Overview. Screening instrument developed for Twin Cities Healthy Start. Participating clinics screen women upon entry into prenatal care. The tool screens for 13 risk domains: telephone access, transportation access, housing instability, food insecurity, social support, depression, intimate partner violence, other physical/sexual abuse, cigarette use, alcohol use, drug use, child protection involvement, legal problems. (Appendix A)

PPRO – Postpartum Risk Overview. Screening instrument developed for Twin Cities Healthy Start. Participating clinics screen women at approximately 6-8 weeks postpartum. The tool screens for 8 risk domains including depression. (Appendix B)

PTB – Preterm Birth. Infants born < 37 weeks gestation.

RAPS4 – Rapid Alcohol Problem Screen

RR – Relative Risk

SCID – Structured Clinical Interview for DSM Disorders

SES – Socioeconomic Status

SGA – Small for Gestational Age. Infants below the 10th percentile for birthweight for gestational age are considered small for gestational age.

TCHS – Twin Cities Healthy Start. A federally funded program that conducts screening for risks using the PRO and PPRO and provides some enhanced case management services to pregnant women receiving care at community based clinics.

Chapter 1: Introduction, Specific Aims, and Project Overview

Objectives

The purpose of this dissertation was to examine two understudied prenatal psychosocial risk factors, social support and prenatal depressive symptoms, in a sample of low-income urban women. Outcomes examined in this dissertation all align with Healthy People 2020 goals: prenatal care attendance (late or inadequate care), poor birth outcomes (i.e., low birthweight, preterm birth, small size for gestational age), and postpartum depression (1). Prior studies on social support and these outcomes are limited methodologically (e.g. small samples, limited adjustment for potential confounders, wide range of social support measures, retrospective collection), while those on depression are characterized by mixed findings with regard to birth outcomes. Studies of associations of prenatal and postpartum depression are growing but many focus on prevalence only providing little information on risk factors associated with persistent depressive symptoms versus those in the prenatal or postpartum period only.

This dissertation aimed to address some of the gaps in the literature by exploring social support and depressive symptoms in a large sample of women who were seeking care at publicly funded community health centers. This sample is representative of those at highest risk for poor outcomes as well as those who would benefit from public health initiatives. This study uses validated measures of depressive symptoms and a comprehensive social support measure with components of friend and partner support. This is one of the few studies able to examine interactions of depressive symptoms and social support in the context of prenatal care and birth outcomes. Additionally we were

able to examine all of these associations in the context of a comprehensive set of social, behavioral, and environmental risks that have been associated with poor birth or other health outcomes but are often not included in research on prenatal care attendance birth outcomes or postpartum depression.

Background

Reducing the prevalence of poor birth outcomes such as low birthweight, preterm birth, or small size for gestational age is a public health priority. Infants who are born low birthweight (LBW), preterm birth (PTB) or small for gestational age (SGA) are at increased risk of infant mortality (2-4) and are more likely to experience short-term illnesses, developmental delays, long-term disabilities, and chronic medical conditions in adult hood (2-5). Public health tracking of these outcomes have consistently indicated that low-income and minority women are more likely than other women to experience poor birth outcomes (i.e., LBW, PTB, and SGA), infant mortality, and maternal complications) (6-8). Low-income women are also more likely to experience some psychosocial (9, 10), behavioral (11, 12), and environmental (13, 14) risk factors associated with poor birth outcomes and poor maternal health including postpartum depression (10, 15, 16).

Prenatal care is the universal public health intervention designed to reduce risk of poor birth outcomes. Adequate and timely prenatal care are associated with reductions in poor birth outcomes, maternal morbidity and mortality, and infant death (17-26). Not receiving care, receiving prenatal care after the first trimester, or receiving inadequate care have

been identified as risk factors for complications (27) including preterm birth (20, 21), low birthweight (22, 25), and infant mortality (23). Unfortunately, low-income and minority women, those most likely to experience poor outcomes, are significantly less likely than others to start care in the first trimester or to receive adequate care (24, 28, 29).

Postpartum depression is a perinatal outcome that has recently become a public health concern. Postpartum depression limits a new mother's ability to care for her infant and puts her at increased risk for drug and alcohol problems as well as suicide. Infants of women experiencing postpartum depression are at increased risk for poor bonding, and developmental delays (30). Prevalence studies indicate higher postpartum depression among low-income populations (10, 16, 31). Depression is both underdiagnosed and undertreated in pregnant and postpartum women (32). It was not until the last year that guidelines on screening for depression indicated that screening should be universal with recommendations in May 2015 from ACOG indicating women should be screened at least once during pregnancy or postpartum (33) and January 2016 from the US Preventive Services Task Force calling for screening in both periods (34).

Improving prenatal care attendance, reducing poor birth outcomes, and reducing postpartum depression are public health priorities. Healthy People 2020 objectives include increasing the proportion of pregnant women who receive prenatal care in the first trimester and who receive both early and adequate care, reducing low birthweight and preterm births, and a new objective focused on reducing the proportion of women who experience postpartum depressive symptoms (1). Public health and prenatal care

providers serving high risk women are challenged to address these goals. Prenatal care providers aim to identify and address modifiable risk factors associated with these outcomes (17, 18). While research has identified some risk factors for poor prenatal care attendance, poor birth outcomes, and postpartum depression among low-income women, there is an identified need for further examination of social determinants and studies that can examine these determinants in combination with personal risk factors (1, 35).

Prenatal depressive symptoms and social support are two potential risk factors that warrant further exploration. It is estimated that 7 – 12% of pregnant women experience major or minor depression (15, 36) with higher prevalences in low-income women and in black women (15, 37-39). Social support is generally defined as assistance exchanged through social relationships (40, 41). Social support, measured a variety of ways, has been identified as a protective factor for many health outcomes(42). Healthy People 2020 identified social support as an important social determinant, emphasizing the need to better understand connections between social determinants, health behaviors, and outcomes (1). Identifying if depressives symptoms are a risk for any of these outcome would contribute previously identified gaps in understanding the benefits of screening for depression (43). Examination of these risks is important as they are potentially modifiable. Examination of them together is important because social support may modify risks associated with depression.

There is limited research exploring either social support or depressive symptoms and prenatal care entry and adequacy. Those examining depressive symptoms and prenatal

care have findings ranged from no association with late care (44), depression associated with entering care early (rather than a risk for late care) (45), and depressive symptoms associated with fewer visits (46). Mixed findings may be related to the varied measures of depression / depressive symptoms in these studies, ranging from a single item on a self-reported checklist (44, 46) to a clinical diagnosis (45). The few studies that have examined the associations between social support and first-trimester prenatal care entry (47, 48) and/or prenatal care adequacy (49-51) have generally shown inverse associations. However, these studies had some methodological limitations including limited adjustment for confounders and collection of measures about prenatal social support experience occurring predominantly in the postpartum period. Theories of social support and prenatal health outcomes include both the potential independent effect as a protective factor as well as a "buffering" effect mediating increased risk from stress, anxiety, and depression (52-59). This association has not been previously examined with regard to prenatal care outcomes.

Depressive symptoms could affect birth outcomes either directly through physiological processes or indirectly by increasing high risk behaviors or poor self-care. Social support may be directly associated with health outcomes independently (through better general health or ability to achieve health through support resources), or as a moderator of the risks associated with depression, stress or anxiety. Results of studies examining maternal depression, or depressive symptoms, and PTB, LBW or SGA are mixed with about half or more of studies finding no association (35, 60, 61). Studies with significant associations for depressive symptoms and birth outcomes are heterogeneous, with regard

to magnitude of risk (60). Country, population, SES, depression measurement timing, and methodological quality are possible factors contributing to the mixed findings (35, 60, 61). Studies about maternal social support and birth outcomes are of variable quality, using a variety of social support definitions, and are often hampered by small sample sizes and lack of control for confounders (58, 59). Very few studies have explored the association of depressive symptoms and social support together with regard to birth outcomes.

In recent years, the media and public health community have focused much attention on postpartum depression. As a result, screening to identify postpartum depression has become more widely promoted (30, 62, 63). While there has been less attention focused on prenatal depression, there is a growing body of literature aimed at understanding how depressive symptoms in the prenatal and postpartum periods are associated and identifying risk factors for depression during these periods. Studies of depressive symptoms have typically focused exclusively on identifying risks for either prenatal or postpartum depression, with a majority of studies focused on postpartum depression. A limited number of prospective studies, from a variety of countries, have examined depressive symptoms in both pregnancy and postpartum. These studies focused primarily on understanding prevalence, with findings generally indicating that prenatal-onset depression is more common than postpartum (10, 64-72), and that nearly half of postpartum cases may have begun in the prenatal period (10, 65). There are few studies about how the risk markers for depressive symptoms may differ for the prenatal or postpartum periods, or how they may be associated with the persistence or “recovery”

from prenatal depressive symptoms (66, 69-71). Previously conducted studies provide some evidence through small sample sizes or a limited set of risk factors. A better understanding of prenatal and postpartum depression prevalence, timing of onset, and the persistence or improvement of symptoms, especially among high risk women, could inform health care and public health guidelines and support services.

Specific Aims

To address gaps in the literature, the aims of this dissertation were to examine associations of two key psychosocial factors, social support and depressive symptoms, with prenatal care attendance and poor birth outcomes (i.e., preterm birth, low birthweight, and small for gestational age), and to explore the associations of prenatal and postpartum depressive symptoms in a racially diverse, urban low-income sample. This study provides several strengths including large sample size, prospective data collection, use of validated measures; and inclusion of a comprehensive set of covariates measuring a range of personal, social, behavioral, and environmental risk factors. Additionally, the sample represents women served by federally funded community health centers and thus is representative of the highest risk for the outcomes examined as well as representative of those who would be reached by public health initiatives to address these outcomes. The aims of the proposal are:

Manuscript #1 - Prenatal care: associations with prenatal depressive symptoms and social support in low-income urban women

Primary aim

To examine the association of depressive symptoms and social support with late prenatal care and with less than adequate care in a low-income, racially diverse, urban clinic-based population.

Secondary aim

To examine if social support modified the association of depressive symptoms with prenatal care.

Manuscript # 2 - An examination of the associations of prenatal depressive symptoms and social support with birth outcomes in a low-income population

Primary aim

To examine the independent association of prenatal depressive symptoms and social support with poor birth outcomes (i.e., preterm birth, low birthweight, and small for gestational age) in a racially diverse group of low-income urban women.

Secondary aim

To examine whether social support moderated the associations between depressive symptoms and birth outcomes.

Manuscript #3 - An examination of prenatal and postpartum depressive symptoms among women served by urban community health centers.

Primary aim

To describe elevated depressive symptom levels in pregnancy and postpartum and characterize the timing of detection and persistence or recurrence of symptoms in a sample of women who received care at urban community health clinics.

Secondary aim

To examine personal, social, behavioral, and environmental correlates of elevated depressive symptom levels in pregnancy only, postpartum only, or during both periods.

Methods Overview

Data

Data for these studies come from the Prenatal Risk Overview (PRO) (Appendix A), Postpartum Risk Overview (PPRO) (Appendix B), and birth certificates. The PRO and PPRO are screening tools used by four urban community based clinics providing services as part of the Twin Cities Healthy Start program. The PRO (Appendix A) is a standardized interview conducted with all women entering prenatal care at these clinics. The PRO screens for 13 risk domains that can be categorized as psychosocial (depressive symptoms, social support), behavioral (cigarette use, alcohol use, drug use), and

environmental (phone access, transportation access, food insecurity, housing instability, partner and other violence, legal problems and child protection). Some women at these clinics are also screened in the postpartum period with the Postpartum Risk Overview (PPRO) (Appendix B) a shorter interview that screens for eight risk domains (including depression) using the same or modified questions from the PRO. The PRO and PPRO are part of the Twin Cities Healthy Start (TCHS) web-based screening and case management data collection system which contains additional data such as demographic information, information about prenatal care and documentation of services provided. For the first and second manuscripts examining prenatal care and birth outcomes, risk screening data were linked with birth certificates for standard measures of birth outcomes, prenatal care entry and level of prenatal care adequacy. For the third manuscript examining prenatal and postpartum depressive symptoms, data comes from the PRO and PPRO assessments in the Twin Cities Healthy Start data collection system.

Sample

The sample for the first and second manuscripts included all women screened prenatally, who gave birth to live born singleton infants for whom a birth certificate was found, and for whom the paper specific measures were available. There were 3,380 women who started prenatal care at five community health centers affiliated with TCHS between 2005 and 2009 and completed the prenatal intake risk assessment. Women were excluded if they had a miscarriage, a fetal death, an elective abortion (n=96), or multiple gestation (n=23). Of the remaining 3,261, we found birth certificates for 2,879 (88%). For the first manuscript, examining prenatal care, an additional 538 were excluded because of missing

data (primarily prenatal care data from the birth certificate), leaving 2,341 women for analyses (72% of those who met inclusion criteria). For the second manuscript, examining birth outcomes, only 11 of the 2,879 women were excluded due to missing data, leaving a final sample of 2,868 (88% of the eligible sample).

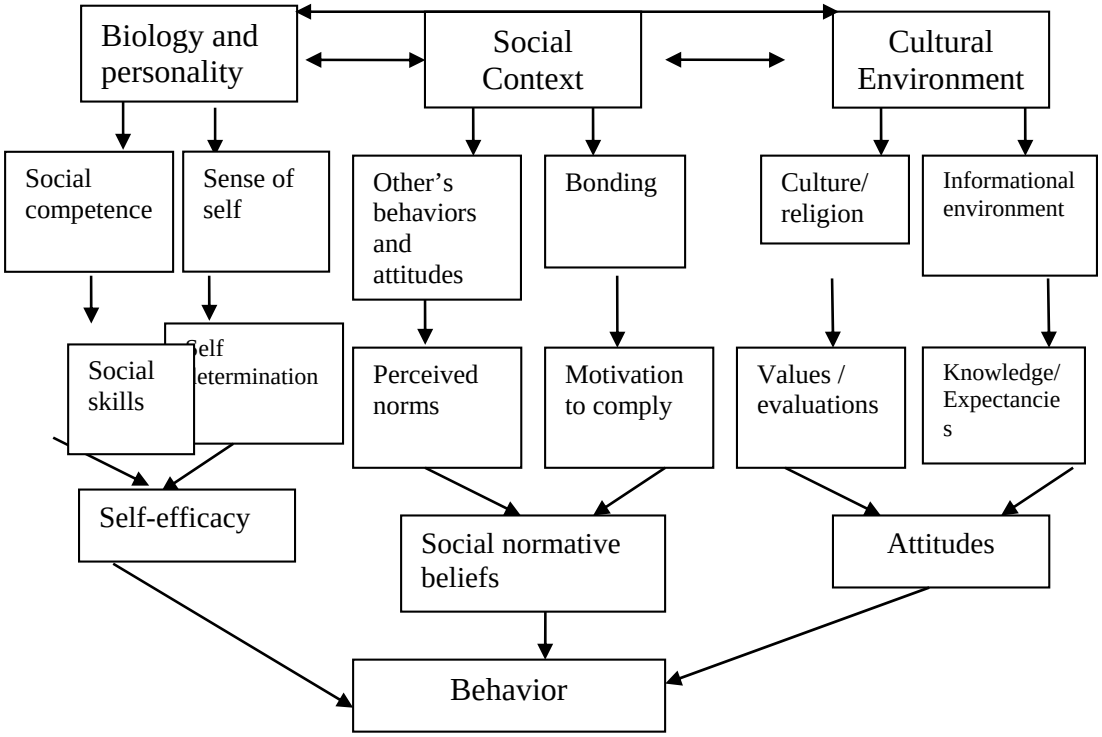
For the third manuscript, examining prenatal and postpartum depressive symptoms, the sample was defined as women who sought prenatal care at five FQHCs during the same time period and who enrolled in the Twin Cities Healthy Start (TCHS) program (which included a systematic process to screen for depressive symptoms in the postpartum period). There were 1,822 women enrolled in the program during the study period. Of those, 728 had both prenatal and postpartum screening data available. Women were excluded if their postpartum screening was conducted too early (i.e., within the first two weeks of delivery) (n=119) or if they were missing data on the timing of their screening (n = 15) leaving a final sample of 594 women (33% of enrollees).

Theoretical Framework

Theories of behavior change are used for providing a framework to study health behaviors and design behavioral interventions. These theories provide a useful framework for describing how the behavior is influenced by many different factors that can then be potentially addressed through interventions. The use of behavioral theories can ensure researchers are measuring important components leading to a behavior or that might be used in an intervention when behavior change is the outcome.

Of the three manuscripts included in this dissertation, only one examined a behavioral outcome. Manuscript #1 examined the outcomes of prenatal care start and adequacy (which combines both when a woman started and how many visits she completed). It is important to note that these measures may not exclusively be behavioral as the outcomes may be influenced by other factors (i.e. when a woman realized she was pregnant and her ability to schedule an appointment when desired). In this dissertation, the broad framework provided by Theory of Triadic Influences (73), was used to guide model development. The Theory of Triadic Influences uses the concept of distal and proximal influences on behavior. Distal influences can come from the person, situation, or broader environment. Proximal influences are cognitive and affective such as attitudes towards the behavior, self-efficacy, and intentions. The Theory of Triadic Influences links three major distal types of influences with three major types of proximal influences through several mediating processes as shown in the figure adapted from an article explaining Theory of Triadic Influences (73).

Figure 1.1 Theory of Triadic Influences



Using this theory to guide the study of prenatal care seeking behavior might group a woman's ability to seek and get prenatal care along with factors such as her acknowledgement of the pregnancy, pregnancy intention into the personality group and these factors influencing her own behavior through self-efficacy. The theory would also consider social context factors such as what she hears from her mother, girlfriends, sisters about prenatal care and the prenatal care seeking behaviors she is exposed to and other factors in her social setting that influence what she considers norms around seeking prenatal care as well as her own motivation to comply with those. It might also be appropriate to put things in the social context like food security, housing stability, social support as these are about a woman's social context and influence her motivation to comply with prenatal care recommendations as they are competing interests. Other behaviors such as drug and alcohol use also influence motivation to comply, as well as

self-efficacy, as well as values and expectations about prenatal care, which demonstrates the cross influence of all of these categories on each other. Cultural and environmental factors might include things such as level of access to prenatal care, poverty, cultural messages about prenatal care, policies guiding access, and educational messages about prenatal care, financial barriers. While it is not possible in this study to measure all factors that could fall under this theoretical framework, especially the cognitive/ proximal factors, this framework will be used to guide the use of the factors measured in the proposed study for examining prenatal care attendance behavior.

The other outcomes examined in Manuscripts # 2 and #3 in this dissertation are not behaviors themselves but rather direct health measures (i.e., low birthweight, preterm birth, small size for gestational age, postpartum depressive symptoms). While behavioral theories are not applicable to these outcomes directly, they do provide a useful framework at a general level for categorizing factors that influence health outcomes. For example, the Theory of Triadic Influences categorizes measures broadly into Personal, Social, and Environmental, showing how these combine to influence states of health. These categories, along with a behavioral category (sometimes included under personal) were used to organize risk factors and covariates in analytical models. The table below shows the full set of factors that used in the three studies. Not all items were used in the analysis of each paper. The italicized factors are the independent measures of interest.

Table 1.1 Independent measures, and covariates categorized within the Theory of Triadic Influences framework

Personal	Behavioral	Social	Environmental
Parity Age US born/ immigrant Race/ethnicity *depressive symptoms*	Pre-pregnancy and prenatal smoking Pre-pregnancy and prenatal alcohol use Pre-pregnancy and prenatal drug use	*Social support* Marital status/ living with father of the baby Intimate partner violence Abuse by someone other than an intimate partner Child protection services involvement	Housing instability Telephone access Transportation access Food instability

Analytical Approach

For manuscripts #1 and #2 examining prenatal care and birth outcomes, TCHS data on risk factors were linked to Minnesota birth certificate data using iterative matching techniques with mother's name, infant and maternal birthdates, and father's name (when available) (74). For manuscript # 3 examining prenatal and postpartum depressive symptoms, the prenatal PRO (Appendix A) were linked to the postpartum depressive symptom measures from the PPRO (Appendix B). After matching, the analytical datasets were created by applying inclusion and exclusion criteria including exclusions due to missing data. After selecting the final analytical samples for each manuscript, descriptive analysis was conducted to compare those included in the final analytical sample with those excluded using cross-tabulations and chi-square tests, or comparisons of means and t-tests where appropriate.

Manuscripts #1 and #2 examining prenatal care and birth outcomes generally followed the same analytical approach. Descriptive analysis were conducted to assess the associations of depressive symptoms, social support measures, and covariates with the outcomes of interest (i.e., late prenatal care and less than adequate prenatal care in manuscript #1; low birthweight, preterm birth, and small size for gestational age in manuscript #2). Cross-tabulations with chi-square and mean comparisons with t-tests were used to examine these associations. Multivariate logistic regression models were examined for each outcome that included depressive symptoms and measures of social support as well as variables that were significant ($p \leq 0.05$) in bivariate analyses. Models were also tested with interactions of depressive symptoms and measures of social support using constructed variables.

For manuscript #3 women were categorized, based on prenatal and postpartum PHQ-9 scores, as having: low depressive symptoms in both periods, elevated symptoms in both periods, elevated symptoms in the prenatal period only, or elevated symptoms in the postpartum period only. Chi-square tests were conducted to examine correlates of elevated depressive symptoms in the different time periods. Mean PHQ-9 scores were compared for prenatal and postpartum using a t-test for paired samples. Multinomial logistic regression was used to examine associations of social, behavioral, and environmental risk factors with categories of elevated depressive symptoms time periods with low symptom levels in both time periods as the reference.

Chapter 2: Manuscript #1 - Prenatal care: associations with prenatal depressive symptoms and social support in low-income urban women

Publication Status: In preparation for submission

Abbey C. Sidebottom, MPH[1]

Wendy L. Hellerstedt, MPH, PhD[2]

Patricia A. Harrison, PhD[3]

Rhonda J. Jones-Webb, DrPH, MPH[2]

[1] Division of Applied Research, Allina Health, 2925 Chicago Avenue, Minneapolis, MN, 55407 USA
[2] Division of Epidemiology and Community Health, University of Minnesota, School of Public Health, 1300 South Second Street, Suite 300, Minneapolis, MN 55454, USA
[3] Minneapolis Health Department, 250 4th Street South, Minneapolis, MN, 55415-1384 USA

SUMMARY

Objective. We examined associations of depressive symptoms and social support with late and inadequate prenatal care in a low-income urban population.

Methods. The sample was prenatal care patients at five community health centers. Measures of depressive symptoms, social support, and covariates were collected at prenatal care entry. Prenatal care entry and adequacy came from birth certificates.

Results. Among 2,341 study participants, 16% percent had elevated depressive symptoms, 70% had moderate/poor social support, 21% had no/low partner support, 37% had late prenatal care, and 29% had less than adequate prenatal care. Women with both no/low partner support and elevated depressive symptoms were at highest risk of late care (AOR 1.85, $p < 0.001$) compared to women with both good partner support and low depressive symptoms. Those with good partner support and elevated depressive symptoms were less likely to have late care (AOR 0.74, $p = 0.051$). Women with moderate/high depressive symptoms were less likely to experience less than adequate care compared to women with low symptoms (AOR 0.73, $p =0.022$).

Conclusion. Screening for, and addressing, low social support and depressive symptoms may help family physicians improve the reproductive health care of women at risk for late or inadequate prenatal care.

INTRODUCTION

Adequate and timely prenatal care are associated with reductions in poor birth outcomes, maternal morbidity and mortality, and infant death (17-26). For that reason, family physicians, obstetricians, pediatricians, and public health professionals provide recommendations about the timing, frequency, and content of care (1, 27, 75). Care includes the assessment of medical and psychosocial risks, continuous health monitoring, clinical diagnostic and treatment procedures, behavioral interventions, and medical and social referrals (17, 18, 27). The most common measures of prenatal care include the timing of the first visit and adequacy of care (measured by an index combining timing of the first visit, number of visits, and pregnancy length) (25). Healthy People 2020 objectives include increasing the proportion of pregnant women who receive prenatal care in the first trimester and who receive adequate care (1). Not receiving care, receiving prenatal care after the first trimester, or receiving inadequate care have been identified as risk factors for complications (27) including preterm birth (20, 21), low birthweight (22, 25), and infant mortality (23). Prenatal care can reduce infant and maternal medical risks (19, 27) by providing family physicians with opportunities to screen women for risks, provide counsel on practices that promote healthy pregnancies, and intervene to address pre-existing conditions and maternal behaviors (27, 76).

The proportion of U.S. women who received care in the first trimester increased from 1990 through 2003 (77), but has been stable since 2003 (78). Low-income and minority women are less likely than others to start care in the first trimester or to receive adequate

care (24, 28, 29), and are more likely to experience poor outcomes (e.g., preterm birth, low birthweight, infant mortality, maternal complications) (6-8).

In addition to race and income disparities, there are several known maternal risk markers for poor prenatal care, including young age (28, 44), poor education (28), high parity (28, 46), unmarried status (28), smoking (28, 45), alcohol or drug use (28, 45), exposure to domestic violence (45, 79), distressed residential neighborhood or poor housing (28, 45, 46), unemployment (44), late pregnancy recognition (28, 80, 81), and unwanted pregnancy (44-46).

Maternal depressive symptoms and low social support are associated with poor birth outcomes (30, 58, 82-85), but findings are mixed about their associations with prenatal care entry and adequacy: a Washington, DC clinic-based study with 303 African-American women found no association between depressive symptoms and late prenatal care (44); a study of 90,000 women found that those with clinical depression had slightly elevated odds (adjusted odds ratio [AOR], 1.16) of entering prenatal care early compared with non-depressed women (45); and a Canadian case-control study of 608 women found that those who had fewer prenatal care visits were 10 times more likely to report prenatal depressive symptoms than those with a greater numbers of visits (46). The methods for measuring depression/depressive symptoms varied in these studies, ranging from a single item on a self-reported checklist (44, 46) to a clinical diagnosis (45).

The few studies that have examined the associations between social support and first-trimester prenatal care entry (47, 48) and/or prenatal care adequacy (49-51) have generally shown inverse associations. Measures in these studies varied widely, ranging from a few items about the general availability of support from specific people (50) to multi-item scales to assess theoretical constructs of support (e.g., instrumental, practical) (47-49, 51) and all but one (48) collected support measures in postpartum or late pregnancy. No study was located that both measured social support at the start of prenatal care and adjusted for salient confounders.

Examining social support and depressive symptoms together aligns with prior findings of lower depressive symptoms among women with higher social support or larger social networks (54, 55, 86). Theories of social support and prenatal health outcomes include both the potential independent effect as a protective factor as well as a "buffering" effect mediating increased risk from stress, anxiety, and depression (52-59). While the association of social support as a modifier for depressive symptoms has been examined with regard to birth outcomes (56, 86), this association has not been examined with regard to prenatal care.

Because of their potential for intervention, we examined the associations of depressive symptoms and social support with late prenatal care and with less than adequate care in a low-income, racially diverse, urban clinic-based population. We hypothesized that women with lower levels of various indices of social support and higher levels of depressive symptoms would be more likely to enter prenatal care late and to have less

than adequate care. We also sought to examine if social support modified the association of depressive symptoms with prenatal care. Decades of research about prenatal care timing and adequacy have identified key correlates and thus confirm the importance of multivariable analyses. We used the Theory of Triadic Influences (73), which identifies major categories of personal, social, and environmental influences that predict behaviors, as a framework to build our analytic models.

METHODS

Study Context

The sample was from the Twin Cities Healthy Start (TCHS) program, one of 105 programs funded by the Health Resources and Services Administration's Healthy Start Initiative. At the time of the study (2005-2009), TCHS, administered by the Minneapolis Health Department, offered outreach and case management services to women receiving prenatal care at several Federally Qualified Health Centers (FQHC). TCHS clinics served a high proportion of African Americans and American Indians because of their disproportionate risks for poor pregnancy and birth outcomes (87).

This study was determined to be exempt from review by the University of Minnesota's Institutional Review Board.

Sample Selection

The study sample was selected from 3380 women who started prenatal care at five community health centers affiliated with TCHS between 2005 and 2009 and completed the prenatal intake risk assessment. Women were excluded if they had a miscarriage, a fetal death, an elective abortion (n=96), or multiple gestation (n=23). Of the remaining 3,261, we found birth certificates for 2,879 (88%). An additional 538 were excluded because of missing data (primarily prenatal care data from the birth certificate), leaving 2,341 women for analyses (72% of those who met inclusion criteria).

Data Collection

Women were screened with the Prenatal Risk Overview (PRO) (Appendix A), a multi-dimensional screening instrument (88) at their first prenatal visit. The drug, alcohol, and depression components of the PRO have high sensitivity and specificity (89-91). The PRO interview was typically conducted by registered nurses, social workers, or paraprofessionals. When medical interpreters were used, standardized translations were provided for Somali, Spanish and Hmong languages.

PRO data were entered into a database that included client-specific demographic, social, and clinical data. These data were linked to Minnesota birth certificate data using iterative matching techniques with mother's name, infant and maternal birthdates, and father's name (when available) (74).

Measures

Dependent Variables

Late prenatal care. The timing of first prenatal care visit was measured by trimester, as reported on the Minnesota birth certificate (1989 U.S. Standard version). We created a dichotomous variable that identified *late care* as care starting in the second or third trimester (1).

Adequacy of prenatal care. We used the Adequacy of Prenatal Care Utilization (APCNU) Index (25, 92). The APCNU combines the month prenatal care began and the proportion of recommended visits received (given timing of initiation of care and gestation at delivery) to categorize prenatal care as Inadequate, Intermediate, Adequate, and Adequate Plus (25, 92). We created a dichotomous variable by grouping Intermediate and Inadequate together as *less than adequate* and grouping Adequate and Adequate Plus as *adequate* (1).

Independent Variables

Depressive symptoms. The PRO (Appendix A) included the Patient Health Questionnaire (PHQ)-9 to assess depressive symptoms (93). It has an estimated sensitivity of 77%, specificity of 94%, and positive predictive value of 59% in primary care populations and has higher (85-90%) accuracy in populations with a high prevalence of depressive disorder (94). We conducted a prenatal validation of the PHQ-9 with TCHS clients and found 85% sensitivity and 84% specificity for major depression disorder (91).

The PHQ-9 assesses physical and mood symptoms of depression with nine items (i.e., little interest or pleasure in things; sleep problems; tired or little energy; appetite issues; restlessness, speaking or moving slowly; feeling down or hopeless; feeling bad about oneself; trouble concentrating; and suicidal ideation). Responses (and scores) about symptoms in the previous two weeks are: not at all (0), several days (1), more than half the days (2), and every day or nearly every day (3). Consistent with scoring guidelines, we summed the responses and categorized the score as *low* (< 10), *moderate* (10-14), and *high* (15-27) (95). Consistent with guidelines for clinical treatment, we created a dichotomous variable that distinguished *low* (< 10) and *moderate/high* (10+) risk for analyses (96).

Social support. We used six items from the Maternal Social Support Index (97) that assessed how many people could be counted on in a time of need or to watch children for several hours; the presence of a boyfriend, husband, or partner and—if present—overall satisfaction with communication; and the presence of another adult with whom women have regular talks and satisfaction with that communication. Women were coded as having *poor social support* if they indicated 1) they had no one to count on in times of need or to take care of children for several hours OR 2) no husband/partner, OR 3) a partner with whom they report unsatisfactory communication AND no adults with whom they regularly communicate satisfactorily. Women who did not meet any of the criteria above were coded as having *moderate social support* if they indicated they 1) had only one person to count on in times of need or to watch children, OR 2) satisfactory communication with a husband/boyfriend or another adult, but not both. *Good social*

support was defined as having more than one person to count on AND satisfactory communication with a husband/partner and another adult. For analyses, we examined *good* vs. *moderate/poor social support*.

We also examined the individual components of social support. The number of people to count on in a time of need and the number of people to watch children for a few hours if needed were categorized as *0-1, 2, 3+*. Partner support was categorized as *No/Low* for women who did not have a partner or had a partner but were unsatisfied with communication with that partner, and *good* for women with a partner who reported they were satisfied with communication with that partner. Similarly, friend support was categorized as *No/Low* for women who either did not have a friend with whom they had regular talks or had a friend but were unsatisfied with communication with that person, and categorized as *Good* for women with a friend with whom they had satisfactory communication.

Covariates

Personal variables. From birth certificate data, we created a dichotomous variable for parity (*0* or *1+ prior live births*). From PRO data, we used a dichotomous measure for foreign-born status and mutually exclusive race/ethnicity categories (*African American; American Indian; Asian/Pacific Islander; Hispanic any race; white; or bi/multiracial*). For analyses, we grouped white and multi-racial because of low numbers in these categories. We collected age as a continuous variable and categorized it as *younger than 20, 20-24 years*, and *25 years and older*.

Women were asked about cigarette smoking one month before pregnancy awareness, using questions from the National Household Survey on Drug Use and Health.(98) Responses options were *none, less than daily, or daily*. For some analyses, we created a dichotomous variable for *any* or *no smoking*.

Questions about alcohol frequency and quantity were from the National Household Survey on Drug Use and Health (98). Questions about alcohol use consequences were from the Rapid Alcohol Problem Screen (99). Responses to questions about frequency, quantity, and consequences in the 12 months before pregnancy awareness were categorized as: *high (*daily or weekly use, with a typical quantity of three or more drinks/day or 4 or more drinks at once on a weekly basis OR report of any alcohol use consequences); *moderate (*monthly drinking, regardless of quantity OR daily or weekly drinking, two drinks or less/day); and *low (*no use, or rare use, regardless of quantity) (89).

Based on the 12 months before pregnancy awareness, women reported whether they used drugs (marijuana or any other drug not prescribed) and frequency of use using a measure from the National Household Survey on Drug Use and Health (98). Responses were categorized into three groups: *never*, *rarely or monthly*, and *weekly or daily*.

Social variables from the PRO. Three questions were adapted from the Abuse Assessment Screen (100) which has good sensitivity, specificity, and test-retest reliability

(101). Women were asked questions about exposures to physical abuse, sexual abuse, and fear of abuse during the 12 months before pregnancy awareness. Questions were asked related to abuse by an intimate partner and by anyone else. We created dichotomous measures (*any abuse* and *no abuse*) for partner abuse and abuse by someone else. Other variables included a dichotomous variable for involvement with Child Protection Services (CPS) as a parent and marital status (coded as *married, single and living with the father of the baby,* or *single and not living with the father of the baby*).

Environmental variables from the PRO. Phone and transportation access were each assessed with one categorical question about frequency of access. *Poor access* was defined as none or rare, *moderate access* was some of the time, and *good access* was all of the time.

Housing instability was assessed with four questions, one from the Homeless Supplement to the Diagnostic Interview Schedule (102) and three generated by TCHS clinic staff to reflect situations they saw patients experiencing. *Unstable* was defined as having lived with family or friends for six months or more in the past year OR having stayed in a shelter for more than two nights in the past year OR self-description that housing was currently unstable OR being very concerned about not having a place to live when the baby was born. *Moderately unstable* was defined as having lived with family or friends for 3-5 months OR stayed in a shelter 1-2 nights in the past year OR being somewhat concerned about having a place to live when the baby was born. *Stable* was defined as

having not stayed in a shelter, not being concerned about having a place to live, and having stayed with relatives or friends less than three months or not at all in the past year.

Food insecurity was measured with four items adapted from the 12-month Food Security Scale of the U.S. Census Current Population Survey (103). The items ask how often, in the last 12 months, the woman: purchased food that did not last and did not have money to buy more; could not afford to eat balanced meals; cut the size of—or skipped—meals; and had been hungry but could not afford to buy food. Responses were: often, sometimes, or never. A summary score ranging from 0-8 was categorized into *high* (6-8), *moderate* (3-5), and *low/no* (0-2) food insecurity.

Statistical Analyses

Using SPSS (version 18, Chicago, IL), we used chi-square analyses to examine differences between included and excluded women and to assess the associations of depressive symptoms, social support measures, and covariates with late and less than adequate prenatal care. We examined multivariable logistic regression models for each outcome that included depressive symptoms and measures of social support as well as variables that were significant ($p \leq 0.05$) in bivariate analyses. We also examined models with interactions of depressive symptoms and measures of social support using constructed variables.

RESULTS

Sample

Excluded women were younger than women in the analytic sample ($p < .001$), less likely to be foreign born (33% vs. 38%; $p = 0.007$), and less likely to have stable housing (47% vs. 51%; $p = 0.046$; Table 2.1).

The analytic sample was racially diverse (43% African American, 20% Asian, 17% Hispanic, 13% American Indian). About two-thirds were younger than 25 years, 57% were single and not living with the father of the baby, 38% were foreign born and, for 12% (n=270), the PRO was conducted in a language other than English. Sixteen percent of the women had PHQ-9 indicating at least moderate levels of depressive symptoms (96), 70% reported moderate or poor overall social support, and 21% reported no/low partner support (Table 2.1). Regarding prenatal care, 37% had late entry and 29% had less than adequate care (Table 2.2).

Late Prenatal Care

In bivariate analyses, low/no partner support, age (< 20), race (Asian, American Indian), and parity (prior births) were associated with late prenatal care (Table 2.2). These associations persisted in multivariable analyses. An interaction was identified for partner support and depressive symptoms (Table 2.3). Women with moderate/high depressive symptoms and no/low partner support were at the highest odds of late prenatal care (AOR 1.85) compared to women with low depressive symptoms and good partner support. The next highest risk of late care was among women with no/low support and low depressive system (AOR 1.27) while those with moderate/high depressive symptoms and good

partner support have lower odds of late care (AOR 0.74) compared to those with good support and low depression. Interactions of depressive symptoms with social support and friend support were not significant.

Less than Adequate Prenatal Care

In bivariate analyses (Table 2.2), depressive symptoms and social support measures were not significantly associated with less than adequate care but in adjusted analyses (Table 2.4), women with moderate/high depressive scores were less likely than women with low scores (AOR 0.73, $p = 0.022$) to receive less than adequate care. Also, women with moderate/poor social support were more likely (AOR 1.29, $p = 0.018$) to get less than adequate care compared to women with good support. There were no significant interactions between depressive symptoms and general social support, partner support, or friend support.

DISCUSSION

Depressive symptoms and social support are possible risk markers for late and inadequate prenatal care but few studies have examined these relationships. In our sample of low-income women, 16% had elevated depressive symptoms and 70% had moderate or poor social support at their first prenatal care intake. Late prenatal care in our sample was 37%, much higher than the state level (14%) (104), and 29% had less than adequate care.

Contrary to our hypothesis, elevated depressive symptoms was not independently associated with late care but was negatively associated with less than adequate prenatal

care. Ours is not the only study to report such findings: others have reported that adults with depression are more likely to receive prenatal (45) and general health care (105-107) than non-depressed individuals. Similar to our findings, a study of African-American women in Washington, DC, found no association between depressive symptoms and late care (44). Another study also found that women with clinical depression were not at risk for late care but rather were more likely to get early care (45).

Our finding that women with elevated depressive symptoms were less likely to have inadequate care conflicts with that of a Canadian study that found that women with inadequate care were more likely to report feeling depressed (46). Differences in methodology could explain these different findings: the Canadian study assessed prenatal depressive symptoms with a single ("you were depressed" yes/no) item in a list of potential barriers for prenatal care. Measures of depression for the study were collected during the hospital stay after delivery with a question that asked if they had delayed care or had difficulties going to care because of a list of barriers thus assessing feelings of depression only as a reason for late/inadequate care. In contrast, we used a validated depression screening tool at entry to prenatal care to assess depression regardless of whether symptoms were perceived as a barrier to care by the patient. One potential explanation for our findings is that, as part of clinic practice, PHQ-9 scores were included in patients' records. It is thus possible that women with higher depressive symptom scores received increased attention from clinic staff that affected prenatal care visits.

As hypothesized, and consistent with other findings, social support was associated with prenatal care: low overall social support was related to less than adequate prenatal care and, a component of the overall measure, partner support, was associated with late entry into prenatal care. While depressive symptoms was not associated independently with late care, a significant interaction was found for partner support and depressive symptoms. Women with elevated depressive symptoms with no/low partner support were at the highest risk of late care compared to women with good support and low depressive symptoms. Women with elevated depressive symptoms and good partner support were less likely to receive late care. Partner support may be a proxy for pregnancy intention or feelings of ambivalence towards pregnancy. Women with no/low partner support may have had challenges addressing the pregnancy with the partner that could have affected timing of start of care. Additionally support of the partner may have been key for addressing logistical challenges with getting into care, particularly in the context of depressive symptoms. Other studies identified an association with father involvement (possibly related to perceived partner support) and the start of prenatal care (108, 109).

Healthy People 2020 identified social support as an important social determinant, emphasizing the need to better understand connections between social determinants, health behaviors, outcomes, and interventions (1). Several pilot projects have shown promise in increasing social support for pregnant or parenting women through a variety of settings and staffing models including phone (110), internet (111), group prenatal care (112, 113), and home visiting (114). Further examination of these models in the context

of prenatal care attendance may help identify opportunities to modify the relationship between poor social support and prenatal care adequacy.

Our sample was predominantly low-income urban residents, and as evident by our description of environmental factors, our sample was also at very high social risk (e.g., only about half reporting stable housing). We consider our sample characteristics to be a strength but it is also likely that our findings may not be generalizable if social factors moderate the associations of social support and depressive symptoms on prenatal care.

Prior studies examining depressive symptoms and late or inadequate care have had mixed results which may be due in part to differences in measures of depression or depressive symptoms as well as timing of the measures (44-46). Those examining lack of social support have had minimal control for confounding (47-51). Additionally, none have examined both depressive symptoms and social support together. The current study builds on this prior work with the use of a validated depressive symptom screening measure and a social support measure inclusive of different support components, both collected at prenatal care entry. An additional strength of our analyses was the availability of a wide variety of environmental and social variables to address confounding, many of which had good psychometric properties and some of which had been specifically tested in TCHS samples (89-91). A limitation to this study is the lack of some variables known to be associated with prenatal care, like pregnancy intention or happiness and timing of pregnancy recognition (44, 45, 81).

We examined social support and depressive symptoms because they offer some opportunity for intervention. Our finding about the association of depressive symptoms and prenatal care adequacy may represent a clinical victory for our clinics if the association reflects persistent prenatal case management with depressive women—and may encourage the importance of attentive reproductive health planning with non-pregnant depressive women in general practice. Our measures of social support and partner support are not specific enough to direct intervention or screening activities, but they do consistently reflect social isolation. Because depressive symptoms and poor support were associated with late entry to prenatal care, the most effective interventions would occur prior to conception. Guidelines for preconception counseling and care include identifying and modifying medical, behavioral, and social risks to a woman's health or pregnancy outcome (115). Family physicians can provide education on the importance of early prenatal care when doing other reproductive health counseling and as they provide general health care to women of reproductive age. Current recommendations for content of preconception and prenatal care by family practice physicians includes screening for depressive symptoms and psychosocial factors with a focus on domestic violence screening (27, 115). Physicians may consider expanding their psychosocial screening to include an assessment of social support during preconception and prenatal care as our data suggest that gauging the strength and variety of social supports may be relevant to understanding the client's future probability of timely and adequate prenatal care in the event of a pregnancy. Poor support may be, in itself, a clinic marker of risk and may thus warrant clinical follow-up of women at risk for pregnancy.

Table 2.1. Comparison of Included and Excluded Women Receiving Care at Twin Cities Healthy Start Clinics, 2005-2009

	Total (n = 3261)	Excluded (n = 920)	Included (n = 2341)	P-value
Personal characteristics, %				
Depressive symptoms				
Low (PHQ-9 < 10)	83.6	82.8	83.9	0.474
Moderate (PHQ-9 10-14)	10.3	10.3	10.4	
High (PHQ-9 15-27)	6.0	6.9	5.7	
Social support				
Good	28.9	27.2	29.6	0.382
Moderate	60.7	61.9	60.2	
Poor	10.4	10.9	10.3	
Partner support				
Good	79.0	79.3	78.9	0.826
No/low	21.0	20.7	21.1	
Age				
< 20	31.4	37.2	29.3	< 0.001
20-24	36.9	35.1	37.6	
25+	31.6	27.7	33.1	
Race				
African American	43.8	46.6	42.7	0.130
Asian/Pacific Islander	19.7	19.2	19.9	
Hispanic	16.6	16.2	16.8	
American Indian	11.9	9.6	12.8	
White	6.0	6.1	6.0	
Multiple	2.0	2.3	1.9	
Foreign born	36.5	32.8	37.9	0.007
Alcohol use, within 12 months before pregnancy awareness				
Low	76.3	77.2	76.3	0.719
Moderate	7.5	7.7	7.5	
High	16.1	15.8	16.2	
Drug use, within 12 months before pregnancy awareness				
Never	77.1	76.0	77.5	0.215
Monthly / rarely	9.0	10.4	8.4	
Daily / weekly	13.9	13.6	14	
Cigarette use, 1 month before pregnancy awareness				
None	71.8	73.0	71.3	0.225
Less than daily	7.5	8.2	7.3	
Daily	20.6	18.8	21.4	

Table 2.1. Comparison of Included and Excluded Women Receiving Care at Twin Cities Healthy Start Clinics, 2005-2009

	Total (n = 3261)	Excluded (n = 920)	Included (n = 2341)	P-value
Social factors, %				
Intimate partner violence within 12 months before pregnancy awareness	6.7	6.6	6.8	0.869
Abuse by someone other than a partner within 12 months before pregnancy awareness	7.3	7.2	7.3	0.864
Child protection involvement	9.6	9.8	9.5	0.907
Marital status				
Married	24.3	21.3	25.5	0.051
Single, living with father of baby	18.1	18.7	17.9	
Single, NOT living with father of baby	57.5	60.0	56.6	
Environmental factors, %				
Phone access				
Good	89.6	89.1	89.8	0.789
Moderate	7.7	8.0	7.6	
Poor	2.7	2.9	2.6	
Transportation access				
Good	52.4	50.8	53.1	0.485
Moderate	37.5	38.9	37.0	
Poor	10.0	10.3	9.9	
Food insecurity				
Low/no	67.1	66.1	67.5	0.366
Moderate	27.2	27.2	27.1	
High	5.7	6.6	5.4	
Housing instability				
Stable	49.8	46.6	51.1	0.046
Moderately unstable	19.6	20.1	19.4	
Unstable	30.6	33.4	29.5	

Table 2.2: Correlates of Late Prenatal Care and Less than adequate Care, among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n =2,341)

	Late Prenatal Care			Less than Adequate Care		
	Not Late (n =1471)	Late Entry (n = 870)		Adequate (n = 1655)	Less than Adequate (n =686)	
	%	%	P-value	%	%	P-value
Depressive symptoms						
Low (PHQ-9 < 10)	84.1	83.9	0.906	83.1	86.3	0.053
Moderate/ High (PHQ-9 ≥10)	15.9	16.1		16.9	13.7	
Social support						
Good	30.3	28.3	0.295	30.6	27.0	0.077
Moderate/poor	69.7	71.1		69.4	73.0	
Individual SS measures						
People to count on in times of need						
0-1	14.3	13.7	0.884	14.1	14.0	0.881
2	19.5	19.2		19.6	18.8	
3+	66.2	67.1		66.2	67.2	
People to take care of child(ren) for several hours if needed						
0-1	22.6	20.5	0.297	21.4	22.9	0.615
2	23.9	26.3		24.6	25.1	
3+	53.5	53.3		54.0	52.0	
Partner support						
Good	80.7	75.9	0.006	79.2	78.2	0.604
No/low	19.3	24.1		20.8	21.8	
Friend support						
Good	84.4	82.8	0.319	84.1	82.9	0.465
No/low	15.6	17.2		15.9	17.1	
Personal characteristics						
Age						
< 20	27.7	32.0	0.028	29.2	29.6	0.020
20-24	37.4	37.9		36.1	41.2	
25+	34.9	30.1		34.7	29.2	

Table 2.2: Correlates of Late Prenatal Care and Less than adequate Care, among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n =2,341)

	Late Prenatal Care			Less than Adequate Care		
	Not Late (n =1471)	Late Entry (n = 870)		Adequate (n = 1655)	Less than Adequate (n =686)	
	%	%	P-value	%	%	P-value
Race						
African American	44.2	40.2	<0.001	43.8	40.1	<0.001
Asian/Pacific Islander	16.6	25.4		19.2	21.5	
Hispanic	18.9	13.2		18.5	12.5	
American Indian	12.1	13.9		10.2	19.0	
White, Multiple	8.2	7.4		8.3	6.9	
Foreign born						
Yes	37.8	38.2	0.854	38.8	35.7	0.168
No	62.2	61.8		61.2	64.3	
Parity						
0	46.9	42.1	0.024	47.1	38.8	<0.001
1+	53.1	57.9		52.3	61.2	
Alcohol use, within 12 months before pregnancy awareness						
Low	75.4	77.1	0.459	76.6	74.5	0.364
Moderate	8.2	6.9		7.8	7.6	
High	16.4	16.0		15.5	17.9	
Drug use, within 12 months before pregnancy awareness						
Never	76.8	78.7	0.514	78.5	75.4	0.044
Monthly or rarely	8.5	8.3		8.7	7.9	
Daily or weekly	14.6	13.0		12.9	16.8	
Cigarette use, 1 month before pregnancy awareness						
None	71.9	70.5	0.628	72.9	67.5	0.009
Less than daily	7.4	7.1		7.4	7.1	
Daily	20.7	22.4		19.7	25.4	
Social factors						
Intimate partner violence within 12 months before pregnancy awareness						
No	93.7	92.3	0.179	93.2	93.3	0.915
Yes	6.3	7.7		6.8	6.7	

Table 2.2: Correlates of Late Prenatal Care and Less than adequate Care, among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n =2,341)

	Late Prenatal Care			Less than Adequate Care		
	Not Late (n =1471)	Late Entry (n = 870)		Adequate (n = 1655)	Less than Adequate (n =686)	
	%	%	P-value	%	%	P-value
Abuse by someone other than a partner within 12 months before pregnancy awareness						
No	92.5	93.0	0.632	92.5	93.0	0.676
Yes	7.5	7.0		7.5	7.0	
Child protection involvement						
No	90.6	90.3	0.775	92.0	87.0	<0.001
Yes	9.4	9.7		8.0	13.0	
Marital status						
Married	24.9	26.5	0.157	25.5	25.4	0.016
Single, living with father of baby	19.1	16.0		16.5	21.4	
Single, NOT living with father of baby	56.0	57.6		58	53.2	
Environmental factors						
Phone access						
Good	89.6	90.1	0.229	90.0	89.2	0.832
Moderate	8.2	6.8		7.5	8.0	
Poor	2.2	3.1		2.5	2.8	
Transportation access						
Good	53.8	51.9	0.341	54.5	49.7	0.100
Moderate	36.9	37.1		36.0	39.3	
Poor	9.3	11.0		9.5	11.0	
Food insecurity						
Low/no	67.9	66.7	0.624	67.2	68.2	0.729
Moderate	26.5	28.2		27.6	26.1	
High	5.6	5.1		5.3	5.7	
Housing instability						
Stable	52.5	48.9	0.226	52.3	48.3	0.100
Moderately unstable	18.7	20.6		19.5	19.2	
Unstable	28.8	30.6		28.2	32.5	

Table 2.3. Final Multivariate Model for Late Entry Into Prenatal Care Among Women Receiving Care at Twin Cities Healthy Start Clinics, 2005-2009, (n = 2341)

	OR	CI	P-value
Partner support*Depressive Symptoms			
Good partner support and low depressive symptoms	Ref		
No/low partner support and low depressive symptoms	1.27	(0.99, 1.62)	0.061
Good partner support and moderate/high depressive symptoms	0.74	(0.54, 1.01)	0.057
No/low partner support and moderate/high depressive symptoms	1.85	(1.31, 2.60)	<0.001
Age			
25+	Ref		
< 25	1.32	(1.07, 1.62)	0.009
Race			
African American	Ref		
Asian/ Pacific Islander	1.73	(1.37, 2.18)	<0.001
Hispanic	0.81	(0.63, 1.05)	0.107
American Indian	1.28	(0.97, 1.67)	0.078
White, Multiple	1.06	(0.76, 1.48)	0.736
Parity			
0	Ref		
1+	1.41	(1.16, 1.71)	<0.001

Table 2.4: Final Model Predicting Less Than Adequate Care Among Women Receiving Care at Twin Cities Healthy Start Clinics, 2005-2009 (n =2341)

	OR	CI	P-value
Social support			
Good	Ref		
Moderate/poor	1.29	(1.05, 1.60)	0.018
Depressive Symptoms			
Low (PHQ-9 < 10)	Ref		
Moderate/high (PHQ-9 ≥ 10)	0.73	(0.56, 0.96)	0.022
Age			
< 25	Ref		
25+	1.60	(1.28, 2.01)	<0.001
Race			
African American	Ref		
Asian/ Pacific Islander	1.11	(0.84, 1.46)	0.461
Hispanic	0.71	(0.53, 0.96)	0.027
American Indian	1.74	(1.29, 2.35)	<0.001
White, Multiple	0.98	(0.67, 1.41)	0.900
Parity			
0	Ref		
1	1.63	(1.32, 2.01)	<0.001
Cigarette use, 1 month before pregnancy awareness			
No	Ref		
Yes	1.08	(0.85, 1.36)	0.550
Drug use, within 12 months before pregnancy awareness			
Never	Ref		
Monthly or rarely	0.87	(0.61, 1.24)	0.448
Daily or weekly	1.13	(0.84, 1.51)	0.411
Child protection involvement			
No	Ref		
Yes	1.31	(0.95, 1.81)	0.104
Marital status			
Married	Ref		
Single, living with father of infant	1.17	(0.86, 1.58)	0.323
Single, NOT living with father of infant	0.85	(0.66, 1.11)	0.237

Chapter 3: Manuscript # 2 - An examination of the associations of prenatal depressive symptoms and social support with birth outcomes in a low-income population

Publication Status: In preparation for submission

Abbey C. Sidebottom, MPH[1]

Wendy L. Hellerstedt, MPH, PhD[2]

[1] Division of Applied Research, Allina Health, 2925 Chicago Avenue, Minneapolis, MN, USA
[2] Division of Epidemiology and Community Health, University of Minnesota, School of Public Health, 1300 South Second Street, Suite 300, Minneapolis, MN 55454, USA

SUMMARY

Objective. The purpose of this study was to examine the associations of maternal prenatal depressive symptoms and social support with infant low birth weight (LBW), preterm birth (PTB), and small size for gestational age (SGA).

Methods. The sample was women who received prenatal care at five community health centers in the Twin Cities between November 2005 and June 2009. We measured depressive symptoms, social support, and covariates at entry to prenatal care and linked maternal survey data to data from her infant's birth certificate. We examined unadjusted and multivariable models for each outcome.

Results. Our sample of 2,899 women with singleton live births was racially diverse (44% African American, 21% Asian, 12% American Indian); 16% were Hispanic. Seven percent of the women had PTB, 8% gave birth to LBW infants, and 14% had SGA infants. The prevalence of elevated depressive symptoms was 16%; 71% of the sample experienced low or moderate social support, 21% had no/low partner support, and 17% had no/low friend support. In unadjusted analyses, depressive symptoms were weakly associated with LBW, but the association did not persist in multivariable analyses. Similarly, partner support was associated with LBW and SGA—and friend support was associated with LBW—in unadjusted analyses only. Depressive symptoms and support variables were not associated with PTB.

Conclusion. In this sample of women with multiple risk factors for poor birth outcomes, depressive symptoms and various measures of social support were not associated with PTB, LBW, or SGA deliveries.

INTRODUCTION

Reducing the prevalences of preterm birth (PTB), low birthweight (LBW), and small size for gestational age (SGA) births are public health priorities (1). Infants affected by any of these birth outcomes are at an increased risk of infant mortality (2-4) and are more likely to experience both short-term illnesses and long-term disabilities, including respiratory problems, vision and hearing loss, infections, and developmental delays (2-4). LBW, PTB, and SGA can increase the risks for chronic medical conditions such as diabetes, other metabolic diseases, hypertension, and heart disease in adulthood (2, 5). Because reducing these outcomes is a public health priority (1, 4), prenatal care providers aim to identify and address modifiable risk factors (17, 18). Depressive symptoms and social support are two such potential risk factors that warrant further exploration.

It is estimated that 7 – 12% of pregnant women experience major or minor depression (15, 36) with higher prevalences in low-income women and in black women (15, 37-39). Maternal depression and depressive symptoms may affect birth outcomes directly through inflammatory markers (e.g., cortisol), exaggerated inflammatory responses, and neurotransmitters (e.g., serotonin, dopamine, norepinephrine) (116, 117). For example, cortisol may directly increase the risk of PTB by triggering the release of placental hormones. Norepinephrine may be associated with intrauterine growth restriction (IUGR) through restricted supply of oxygen and nutrients to the fetus (30, 83, 116-118). Maternal depression and depressive symptoms may also indirectly affect birth outcomes through their associations with coping behaviors that directly increase the risks for poor fetal growth, such as smoking, alcohol use, drug use, and poor nutrition (30, 60, 119) or

through their associations with diminished health and functioning status (120). Results of studies examining maternal depression, or depressive symptoms, and PTB, LBW or SGA are mixed, with several reporting no association (35, 60, 61). Studies with significant associations for depressive symptoms and birth outcomes are heterogeneous, with regard to magnitude of risk (60). Country, population, SES, depression measurement timing, and methodological quality are possible factors contributing to the mixed findings (35, 60, 61). The interpretation of what mixed findings mean varies as well. One review covering a 36 year period and examined prospective studies using a validated depression screening tool or diagnosis. The authors concluded that, after taking into account methodological qualities, the evidence about depression and PTB is inconclusive with less than a quarter of 50 PTB studies finding an association (61). The same review concluded there is evidence of a positive association between prenatal depression or depressive symptoms and LBW with slightly more than half of the 33 studies they examined showing an association (61). Conversely, another review examining a 36 studies of over a 15 year period, concluded that depression was a risk factor for PTB and SGA while indicating the evidence for LBW suggested a risk but was less consistent (35). Finally, a meta-analysis of 29 prospective studies over a 29 year period found weak, positive associations between depressive symptoms and birth outcomes; they reported and pooled effect sizes (RR) of 1.39 for PTB and 1.49 for LBW with an indication that magnitude may be impacted by depression measurement, country of study and socioeconomic status of the population (60). While small, these pooled effect sizes suggest potential for a large population health impact if depression is associated with these outcomes (60). The mixed findings, questions about methods, and population context identified in these reviews (35, 60, 61)

suggest a need for further examination. One review author concluded there was a need for more observational studies that include measures of behavioral and psychosocial determinants and that explore interactions between depressive symptoms and other psychosocial factors (35).

Maternal social support is another potentially modifiable psychosocial factor that may be related to birth outcomes, but it has not been as heavily studied as depressive symptoms. Social support is generally defined as assistance exchanged through social relationships (40, 41). Social support may be an independent protective factor for good birth outcomes and/or may act indirectly by "buffering" the risks that are associated with stress, anxiety, trauma, and depression (52-59). Studies about maternal social support and birth outcomes are of variable quality, often hampered by small sample sizes and lack of control for confounders (58, 59). Especially relevant is the wide variety of measures of maternal social support that include the size of a person's social network, specific social ties (e.g., marital status, number of close friends) (52, 54), perceived available support from different people (52, 53, 55-57, 121), actual support received from different people (54, 56), as well as receipt of specific types of support (instrumental, emotional, informational) (53-55, 58). Only two studies have examined both depressive symptoms and social support and birth outcomes (56, 86). A study of 537 Ethiopian women enrolled in the second and third trimester found that both low social support and depressive symptoms were positively associated with LBW (56). Another study (86) of 235 well-educated women in Iowa recruited at or before 28 weeks gestation identified an interaction between partner support and depressive symptoms in models examining

gestational age as a continuous outcome. Depressed women with low partner support had infants born earlier than depressed women with high partner support, indicating a potentially buffering effect of partner support.

The goal of this study was to examine the independent associations of prenatal depressive symptoms and social support with poor birth outcomes (i.e., PTB, LBW, and SGA) in a racially diverse group of low-income urban women. Examination of these factors is important because they are both potentially modifiable through clinical or public health interventions. Our hypotheses were that elevated depressive symptoms and low social support would be independently associated with increased risk of poor birth outcomes. Some of the uncertainty about depressive symptoms and social support are related to weaknesses in study methods. The current study addresses some of those weaknesses by having a large sample representative of women receiving care at community health clinics who were surveyed with valid and reliable measures of depressive symptoms, various components of social support, and demographic, behavioral and environmental variables. We designed our analyses to control for potential confounders. Because existing data are limited, we also examined whether social support moderated the associations between depressive symptoms and birth outcomes.

METHODS

Study Context

The study sample was from the Twin Cities Healthy Start (TCHS) program, one of 105 programs funded by the Health Resources and Services Administration's Healthy Start Initiative. At the time of the study, TCHS, administered by the Minneapolis Health Department, offered outreach and case management services to women receiving prenatal care at several community health clinics (all were Federally Qualified Health Centers (FQHC) or FQHC look-alike clinics). TCHS operated at clinics that served a high proportion of African American and American Indian patients because they had the highest rates of infant mortality in the Twin Cities and in Minnesota (87).

This study was determined to be exempt from review by the University of Minnesota's Institutional Review Board.

Sample

The study sample was all women who received prenatal care at five community health centers affiliated with the TCHS program between November 2005 and June 2009. Women were excluded from analyses if they had a miscarriage, a fetal death, or an elective abortion. Those with live births were included if a birth certificate for their offspring was found that contained complete birth outcome data.

Data Collection

The 10-15 minute Prenatal Risk Overview (PRO) interview was typically conducted by registered nurses, social workers, or paraprofessionals at the end of the first prenatal appointment. The first visit was the first trimester for 43% of the sample, the second

trimester for 38% of the sample, and the third trimester for 10% of the sample; data were missing for 9%. The PRO was designed to include risk factors that were linked to poor birth outcomes and prenatal care attendance (88-90, 122, 123). It has 58 questions in 13 domains: depressive symptoms (the Patient Health Questionnaire (PHQ)-9), social support, telephone access, transportation access, food insecurity, housing instability, partner violence, physical or sexual abuse by a non-partner, cigarette smoking, alcohol use, drug use, legal problems, and Child Protection involvement (88). Ten percent of the PRO assessments were conducted in a language other than English.

PRO data were entered into an electronic database and linked to demographic and other client data. Minnesota birth certificate data for the clients' infants were then linked to these clinic records by the Minnesota Department of Health, using iterative matching techniques with mother's name, infant and maternal birthdates, and father's name (when available) (74).

Measures

Dependent Variables

Preterm birth. We defined preterm births as those occurring before 37 completed weeks gestation, according to the physician's estimate of gestational age birth certificate.

Low birthweight. We classified infants reported to weight less than 2500 grams at birth on the birth certificate as having low birthweight.

Small for gestational age. We classified infants as small for gestational age if they were below the 10th percentile in birthweight for their gestational age at birth and sex based on a recent reference reflecting the US population (124).

Independent Variables

Depressive symptoms. The PRO included the PHQ-9 to assess depressive symptoms (93). The PHQ-9 has been widely tested in diverse cultural and geographic populations (94, 95, 125-130). A review of its diagnostic accuracy estimated a sensitivity of 77% (range of 71-84%), specificity of 94% (range of 90 – 97%), and a positive predictive value of 59% in primary care populations and higher sensitivity (85-90%) in populations with a high prevalence of depressive disorder (94). We conducted a validation study of the PHQ-9 in a prenatal population and found 85% sensitivity and 84% specificity for major depression disorder (91).

The PHQ-9 assesses physical and mood symptoms of depression with nine items about the previous two weeks: little interest or pleasure in things; sleep problems; tired or little energy; appetite issues; restlessness, speaking or moving slowly; feeling down or hopeless; trouble concentrating; feeling bad about oneself; and suicidal ideation. Responses (and scores) are: not at all (0), several days (1), more than half the days (2), and every day or nearly every day (3). We created a dichotomous variable that distinguished *low* (< 10) and *moderate/high* (10+) risk for analyses, which aligns with the PHQ-9 guidelines for scoring and clinical treatment (95, 96).

Social Support. We used six items from the Maternal Social Support Index (97) that assessed how many people pregnant women could identify that could be counted on in a time of need, or to watch their children for several hours; the presence of a boyfriend, husband, or partner and—if present—overall satisfaction with communication with that person; and the presence of another adult with whom they had regular talks, as well as satisfaction with that communication. We coded women as having *poor* social support if they indicated that they had: 1) no one to count on in times of need or to take care of their children for several hours OR 2) no husband/partner OR 3) a partner with whom they reported unsatisfactory communication AND no adults with whom they regularly communicated satisfactorily. We coded women who did not meet any of these criteria as having m*oderate* social support if they indicated that they had: 1) only one person to count on in times of need or to take care of their children, OR 2) satisfactory communication with a husband/boyfriend or another adult, but not both. We defined *good* social support as having more than one person to count on AND satisfactory communication with a husband/partner and another adult. For analyses, we examined *good* vs. *moderate/poor* social support.

We also examined the individual components of social support. We categorized the total number of people to count on in a time of need and the total number of people to take care of their children for several hours if needed each as *0-1, 2, 3+*. We categorized partner support as *no/low* for women who did not have a partner OR had a partner but were unsatisfied with communication with that partner. We categorized partner support as *good* for women who had a partner with whom they reported they were satisfied with

communication. Similarly, we categorized friend support as *no/low* for women who either did not have a friend with whom they had regular talks OR had a friend but were unsatisfied with communication with that person. We categorized friend support as g*ood* for women who had a friend with whom they had satisfactory communication.

Covariates

Covariates included demographics, parity, health behaviors, exposure to abuse, and environmental measures. We selected covariates that had been identified as associated with birth outcomes in the literature, had been indicated as potential barriers to prenatal care attendance (e.g., transportation and phone access) by clinic staff in the study clinics (88) and were available through prenatal screening or birth certificates.

Demographics. We included demographic variables that have been associated with birth outcomes: age (131), foreign-born nativity (132), race/ethnicity (6), and marital status (133). From PRO data, we used a dichotomous measure for foreign-born status and mutually exclusive race categories (African American, American Indian, Asian/Pacific Islander, Hispanic (any race), white, or bi/multiracial). For analysis we grouped white and multi-racial women because of small numbers in these categories. We collected age as a continuous variable and categorized it as *younger than 20, 20-24 years, and 25 years and older*. Marital status was categorized as *married, single and living with the father of the baby, or single and not living with the father of the baby.*

Parity and health behaviors. Parity (134), smoking (135), alcohol use (136, 137), and drug use (13) have all been identified as associated with increased risk for poor birth outcomes. From birth certificate data, we created a dichotomous variable for parity *(0 or 1+ prior live births).* Smoking, alcohol, and drug use quantity and frequency questions on the PRO were from the National Household Survey on Drug Use and Health (98). Two time frames were addressed for each of these behaviors: before pregnancy awareness (one month for smoking, 12 months for alcohol and drug use) and after pregnancy awareness. We measured smoking frequency as days per week (daily, less than daily, not at all) and average number of cigarettes per day. We coded women who smoked during pregnancy OR were daily smokers prior to pregnancy awareness as having *moderate/high* exposure. We coded women who reported they did not smoke during either period OR smoked prior to pregnancy awareness less frequently than daily, as having *no/low* exposure.

In addition to frequency and quantity questions, the alcohol measure included consequence or drinking pattern questions from the Rapid Alcohol Problem Screen (99) which asked women about feeling guilty after drinking, being told about things they did while drinking that they could not remember, neglecting responsibilities because of drinking, or drinking in the morning. We categorized responses to questions about frequency, quantity, consequences, and patterns in the 12 months before knowledge of pregnancy and questions about frequency and quantity since pregnancy awareness into two levels. We defined *moderate/high* alcohol use as any alcohol use after pregnancy awareness; OR experiencing any adverse consequences/patterns related to drinking prior

to pregnancy; OR a typical pattern of drinking in the year before pregnancy awareness of either two or more drinks daily, three or more drinks per occasion weekly or more often; or four drinks per occasion once per month or more frequently. We defined *no/low* alcohol use as no use after pregnancy awareness AND no adverse consequences/patterns prior to pregnancy awareness AND EITHER (1) no alcohol use prior to pregnancy awareness OR (2) typical use in the year prior to pregnancy awareness of one drink at any frequency level, two drinks on a single occasion at a weekly or monthly occasion, or three drinks on a single occasion monthly or rarely.

We used three questions to assess drug use. Two items assessed frequency (i.e., daily, weekly, monthly, rarely, never) during two time periods: the 12 months prior to pregnancy awareness and since pregnancy. One item adapted from the Rapid Alcohol Problem Screen (99) asked about neglecting responsibilities because of drug use in the prior 12 months. We coded a dichotomous measure of drug use as *yes* if a woman reported any use during either period OR neglected responsibilities and *no* if responses were all negative.

Exposure to abuse. Because exposure to interpersonal violence has been associated with pregnancy outcomes (138, 139), we asked three yes/ no questions, adapted from the Abuse Assessment Screen, (100) to assess exposures to physical abuse, sexual abuse, and fear of abuse. We asked women these questions in reference to two periods, the 12 months before pregnancy awareness and since pregnancy. We asked a set of six questions each about an intimate partner and also about anyone else. We created dichotomous

variables for partner abuse and abuse by someone else, with a yes response to any of the six items coded as *yes* for abuse. For analysis, we combined responses about the two sources of abuse (intimate partner or someone else) into a single measure reflecting any exposure to abuse.

Environmental variables. Because a variety of environmental risks, ranging from housing instability (13) to food insecurity (140), could affect pregnancy outcomes, the PRO included several measures of residential quality. We asked separate categorical questions about how often women had access to a phone or transportation. We coded responses of none of the time, rarely and some of the time as m*oderate/poor* access and responses of all of the time as *good* access.

We assessed housing instability with four questions, one from the Homeless Supplement to the Diagnostic Interview Schedule (102) and three generated by TCHS clinic staff to reflect situations they saw patients experiencing. We defined *unstable* as having lived with family or friends for three months or more out of the past year OR having stayed in a shelter in the past year OR self-description that housing was currently unstable OR being somewhat or very concerned about not having a place to live when the baby was born. We defined *stable* as having not stayed in a shelter, not being concerned about having a place to live, AND having stayed with relatives or friends less than three months or not at all.

We measured food insecurity with four items adapted from the 12-month Food Security Scale of the U.S. Census Current Population Survey (103). The items asked about how often, in the last 12 months, women purchased food that did not last and did not have money to buy more; they could not afford to eat balanced meals; they cut the size of—or skipped—meals; and they had been hungry but could not afford to buy food. Responses for each question were: often, sometimes, or never. We categorized a summary score ranging from 0-8 into *moderate/high* food insecurity (3-8) and *no/low* food insecurity (0-2).

We also created a measure quantifying how many of the four previously described environmental factors were reported and categorized this summary measure of environmental risks as *0, 1, 2-4.*

Statistical Analyses

We conducted statistical analysis with SPSS (version 18, SPSS Inc, Chicago, IL). We used Chi-square analyses to examine differences between included and excluded women in the sample and to assess the associations of depressive symptoms, social support, and covariates with birth outcomes. We used t-tests to examine mean differences in gestational age and birthweight for dichotomous measures of depressive symptoms and social support. We examined multivariable models for each birth outcome that included our measures of depressive symptoms and social support with adjustment for significant ($p \leq 0.05$) covariates. We also examined the interactions of social support and partner support and depressive symptoms (i.e., whether social support buffered the association of

depressive symptoms) for LBW because LBW was the only outcome significantly associated with depressive symptoms.

RESULTS

Sample

During the study period, 3,380 women were screened with the PRO: 96 were excluded from our analyses because they experienced a miscarriage, a fetal death, or had an elective abortion; and 23 were excluded because they gave birth to twins. Of the remaining 3,261, we found birth certificates for 2,879. After we linked the TCHS and birth certificate data, we excluded 11 women who had missing birth outcome data, leaving a final sample of 2,868 (88% of the eligible sample).

We compared the TCHS data of women who were excluded and included in the final sample and found they differed for two measures: race and marital status (data not shown). The final sample includes a higher proportion of married women compared to those who were excluded (25% vs. 19%, $p = 0.047$), a higher proportion of Asian/ Pacific Islander women (20% vs. 13%, $p = 0.003$), and a lower proportion of Hispanic women (16% vs. 22%, $p = 0.003$).

The sample available for analyses was racially diverse (43.5% African American, 21% Asian/Pacific Islander, 16% Hispanic, and 12% American Indian), with 37% of the sample born outside the US (Table 1). The sample was also young, with 68% of the women younger than 25 years-old (mean age 23.0 years, SD 5.8). The PHQ-9 score for

17% of the women was 10 or higher (indicating at least a moderate degree of depressive symptoms) and 71% of the sample had moderate/poor social support levels, with 21% reporting no/low partner support. PTB occurred for 7% of the women, 8% gave birth to LBW infants, and 14% had SGA infants (Table 2). Two-thirds (66%) of the LBW births were also PTB and 68% of the PTB were also LBW (Table 2). Twenty-six percent of the SGA infants were LBW and 8% were born preterm.

Birthweight

In bivariate associations, depressive symptoms was associated with LBW births (Table 1). Measures of friend and partner support were associated with LBW, while social support and measures of people to count on or watch children in times of needs were not (Table 1). Associations of friend and partner support became non-significant after adjustment for significant covariates (Table 4). In separate analyses, we also examined the interactions of depressive symptoms and the social support measures (i.e., partner support, friend support, social support) to test if social support moderated the association of depressive symptoms and LBW. None of these interactions were significant ($p < .05$) (not shown). Mean infant birthweight did not vary for women with low and moderate/high depressive symptoms, nor did it vary for social support or friend support. Women with no/low partner support had infants with a mean birthweight 76 grams lower than those with good partner support ($p < .01$) (Table 3).

Preterm Birth and Gestational Age

Neither depressive symptoms nor any of the social support measures were associated ($p < .05$) with PTB in unadjusted (Table 1) or adjusted (Table 5) analyses. Mean gestational age was also not associated with depressive symptoms or any of the social support measures (Table 3).

Small for Gestational Age

In unadjusted analyses, partner support was the only support measure associated with SGA but this association became non-significant after adjustment for significant covariates (Table 6). Depressive symptom level was not associated ($p < .05$) in unadjusted (Table 1) or adjusted (Table 6) analyses.

Because the timing of depressive symptom measurement may affect the association of depressive symptoms and birth outcomes (61), we conducted additional analyses to examine whether the trimester of depressive symptom assessment was independently associated with the outcomes and whether the inclusion of trimester of assessment in the adjusted models changed the associations of depressive symptoms and outcomes. We found no significant associations between assessment timing and outcomes nor did the associations change when the variable for the timing of assessment was added to models (data not shown).

DISCUSSION

Depressive symptoms and social support have been identified as possible risk markers for poor birth outcomes, (35, 58, 60, 61) but few studies have examined whether they

confound or interact with one another. We found that, in our sample of low-income women who were receiving prenatal care at publicly funded clinics, that depressive symptoms and social support were not associated with birth outcomes. While we found some associations in unadjusted analyses, they disappeared when we adjusted for the many other demographic, social, and environmental variables we measured. Our findings could be specific to our socially vulnerable sample or it may have broader generalizability to similar women. Our sample was characterized by poor support with 71% having poor or moderate social support and 21% with no/low partner support at the time they started prenatal care.

The prevalence of elevated depressive symptoms at prenatal intake was 17%, which is higher than the general population prevalence estimates of 7 – 12% reported in reviews and meta-analyses (15, 36). This is not surprising given that depressive symptoms tend to be higher in both low-income and in African American populations (15, 37-39). We used a well-tested and conventional measure of depressive symptoms, the PHQ-9, which provides some re-assurance that we did not misclassify women and thus bias our analyses. We did not have other measures of psychological well-being, like anxiety or stress, and thus we could not capture a complete picture of potentially intervenable mental health issues that could be associated with birth outcomes.

Birth Outcomes and Depressive Symptoms

Literature reviews of studies that have examined depressive symptoms and birth outcomes find that perhaps half or more of the selected studies report non-significant

findings and suggest they may be attributable to a real lack of association or study biases related to sample selection or methods (35, 60, 61). To compare our findings with that of others, we reviewed 14 individual studies that examined outcomes of PTB, LBW, or SGA and met the following criteria: they were conducted in the U.S., they were prospective, they used a validated depressive symptom screening tool or diagnosis (e.g., PHQ-9, CESD, SCID, Beck, EPDS), and had a sample size greater than 100.

Thirteen studies examined depressive symptoms as a risk factor for PTB (82, 86, 141-151) and only five (82, 146, 149-151) found that depressive symptoms were a predictor of PTB with adjusted ORs ranging from 1.3 (95% CI: 1.09, 1.35) in a sample of 14,175 predominantly white (71%) women getting care in a large health system (151) to 3.9 (95% CI: 3.24, 3.56) in a study of 389 urban black and Puerto Rican women receiving prenatal care at two hospital-based clinics in Camden, New Jersey (150). Adjustment variables ranged from just a few (typically age, race, parity) to sets of covariates including more demographics, behaviors, and biomedical info (i.e., education, marital status, alcohol use, smoking, drug use, BMI, hypertension, diabetes). Seven studies examined depressive symptoms as a risk factor for LBW (86, 141, 144, 147-150) and three reported significant associations (147, 148, 150). Adjusted odds ratios for LBW ranged from 1.40 (95% CI: 1.1, 1.7) in a sample of 3,149 mostly African American women receiving care at a county health department in Alabama after adjustment for demographics, behaviors, and medical covariates (147) to 3.97 (95% CI: 3.8, 4.15) in the sample of 389 inner city, primarily non-white women from New Jersey clinics adjusted for race, prepregnancy BMI, inadequate weight gain, smoking, parity, and history of

LBW (150). Five studies examined SGA (141, 145, 147, 149, 150). Only the previously mentioned study of women at clinics in New Jersey (150) found an association, reporting an OR of 3.02 (95% CI: 2.88, 3.17) after adjustment for prepregnancy BMI, inadequate weight gain, smoking, a history of prior LBW infant. Another study (145) of 666 pregnant white (98%) women recruited from large obstetrics practices in New York and Pennsylvania in the late 1980's found no association overall between depression and size for gestational age as a continuous variable. The study did find an association within the sub-sample of lower SES women (n = 222), after adjustment for smoking, demographic, obstetric, life event stressors, and social support. The findings estimated low income SES women would experience a reduction of 9.1 grams (95% CI: - 16.0, - 2.3) in gestational age adjusted birth weight for each depression symptom increase (measured by the CESD).

We examined the qualities of the studies that found positive associations between depression or depressive symptoms and birth outcomes and those that did not (including the present study). We did not find a design element that distinguished them and thus could possibly explain why we, and others, found no associations. All of the studies we examined generally included adjustment for key covariates, including at minimum maternal age (86, 141-143, 145, 146, 148, 151), race/ ethnicity (86, 141, 143, 144, 146-148, 150), parity or gravidity (86, 142, 143, 145-147, 150); many also included adjustment for marital status (141, 142), education (141, 142, 146, 147), prenatal smoking (82, 86, 141-147, 150), alcohol use (82, 141, 142, 144, 147), drug use (82, 141, 144, 148); some also adjusted for pre-pregnancy BMI (82, 142-144, 147, 150), and

medical conditions (82, 86, 142, 144-147, 150) like hypertension, diabetes, and prior pregnancy outcomes. Our study included covariates common to most studies as well as less common measures about environmental and social risks, including phone and transportation access, food insecurity, and experience of domestic abuse. While we did not have some measures that are associated with birth outcomes (e.g., pregnancy history, maternal BMI), we noted that studies including these measures still experienced mixed results. We also found that the study sample demographics (e.g., income, race distribution) did not distinguish studies that found significant associations from those that did not.

The timing of the measurement of depressive symptoms could be important in assessing its association with birth outcomes (61), assuming that the magnitude or presence of depressive symptoms could vary during pregnancy. We did not see patterns of measurement among the studies we reviewed that would distinguish those that found associations and those that did not. The studies that found a positive association between LBW and depression or depressive symptoms measured depressive symptoms at various points during pregnancy: in the first and second trimester (82), at entry into prenatal care (148), 22-23 weeks gestation (147), approximately 19 weeks (152), and in the third trimester (150). Those that did not report an association measured depression or depressive symptoms at 24-29 weeks (141, 144) and in both the first and second trimester (86). Studies of PTB had a similar range of measurement timing, with no clear pattern distinguishing those that found a positive association from those that did not. In our

study, the timing of measurement varied. We found that adjustment for the timing did not modify the results for any of the three outcomes we examined.

Birth Outcomes and Social Support

We examined several measures of social support generally and specifically related to partners and friends. While we found unadjusted associations for partner support with LBW and SGA and friend support with LBW, none persisted after adjustment. Social support is measured in many different ways in birth outcomes research (58, 59), complicating comparisons among studies although, in general, our finding of no associations with birth outcomes aligns with those of many recent US studies.

The initial studies, conducted in the 1970's and 1980's, that identified social support as a potential protective factor during pregnancy, did not examine birth outcomes specifically but rather created composite outcomes of several pregnancy complications and infant outcomes (58, 153, 154). Several subsequent studies that examined social support measures with specific birth outcomes had several methodological limitations including small sample sizes, lack of adjustment for confounders, and some collected social support measures in the postpartum period (53, 54, 58, 59, 155-159). As summarized in review articles (58, 59), there are mixed findings about the associations of social support and birth weight and/or gestational age outcomes. Several studies identified associations only in sub-populations. A German study of 896 women found social support was only associated with birth outcomes among smokers finding a greater risk of PTB among smokers with low support than smokers with good support (55). Two prospective studies

found an association with SGA. The first, a study of 872 Swedish women (160) found a protective association between social support and SGA after adjustment for smoking, alcohol use, exercise, education level, country of origin, maternal age and height. The second, a US study of 247 Latina (47%) and non-Hispanic white (43%) women reported that social support (which included measures of general support, family support, and baby's father support) was inversely associated with SGA after adjustment for obstetric risk, ethnicity, and infant sex (53).

Several prospective studies conducted in the US have reported no association between various measures of social support and birth weight as a continuous variable, while some report findings only in a subset of the population or for specific measures. These included correlation analysis in a study of 119 African American women in North Carolina using a 39-item scale to measure support (121); and an analysis of 235 predominantly white, married women in Iowa using a 6-item support network scale and a 42-item measure of partner support with analysis that adjusted for age, number of children, income, education, pregnancy intention, prenatal smoking, medical condition, prior complications (86). A study of 129 predominantly Hispanic and African American women with several subscales measuring support received from different sources, and satisfaction with the support reported mixed findings: in analyses adjusted for medical factors, the amount and quality of support received were not associated with birthweight but the size of a woman's network for available support was positively associated with birth weight (54). Another study with US born and foreign born Latina women and US born non-Hispanic women (n = 265) found social support (measured using a 19-item scale) predicted higher

birthweight (using unadjusted correlation analyses) only among the foreign born Latinas but not among the US born women (161).

We also did not find any evidence of an interaction between social support and depressive symptoms. We located only one other study that examined this and it reported mixed findings. Nylen et al., (86) in a study of 235 (94% white, 86% married) women in Iowa, found no main effects of either depression diagnosis or social support with birthweight and no significant interactions. In contrast, they found that poor perceived partner support in depressed women increased the risk of earlier birth but was not associated with gestational age at delivery in non-depressed women.

Strengths and Limitations

Studies that find no associations have a greater burden to defend the strength of their study design and analyses. We collected data prospectively, using conventional measures of social support (97) and depressive symptoms (93). Our outcomes are from birth certificate data, generally considered to be an unbiased source of information about birthweight and gestational age (162, 163). We used a recent US reference to calculate SGA (124) an outcome that is infrequently examined relative to its association with social support and depressive symptoms. We had a large set of covariates, including behavioral, social, and environmental measures, which allowed us to examine robust models. We had a large sample size and cannot assert that our finding of no significant associations was related to inadequate analytical power.

Our sample was racially diverse population; 10% of the women required English translators. They had a concentration of multiple risk factors that could contribute to poor birth outcomes: 50% reported unstable housing, 47% had limited transportation access, 33% reported food insecurity, 25% reported smoking during pregnancy or on a daily basis prior to pregnancy, and 23% reported drug use during or in the year prior to pregnancy. Risk markers that are often associated with LBW, like maternal age and parity (131, 134), were not associated in our sample. Our sample was thus not similar to the general population, but we have no evidence that our findings will not generalize to clients who are served by public health programs and agencies for low-income women. And, while we were missing some data for 12% of the eligible women and could thus not include them in the analyses, we found few differences between included and excluded women, further suggesting that our sample was a good representation of a specific type of clientele.

There is an important quality to our sample that bears reflection: all of the women were integrated into a public health system of care at some point during their pregnancies. Given our familiarity with that system, we know that referrals for mental health assessment were standard protocol as a result of the PHQ-9 results. While we do not have data on completion of assessments or any additional treatment, program and clinical leadership at these sites reported low levels of follow through with mental health assessments were common. Lack of follow through with mental health professional referrals is not surprising in this population. A screening study in a very similar population found only about half (57%) of women with elevated symptoms were willing

to talk with a health care provider about their feelings. Fewer, (42%) said they were willing to talk with a mental health professional, most preferred an obstetrician or midwife (83%), and nearly all (92%) wanted to talk with a social worker about financial or housing problems. It is possible that some women in our sample who were screened for depressive symptoms also received referrals and effective treatment. If this is the case, it is also possible that those with depressive symptoms at some point in their pregnancies spent most of their pregnancies receiving treatment and relief from their symptoms. Using this reasoning, a true analyses of depressive symptoms and birth outcomes would require ongoing assessment and documentation of intervention. We have not found any study of depressive symptoms and other health outcomes that has such a thorough, and likely important, level of detail.

An important omission in our analyses—and in the study of social support and depressive symptoms generally—is that our study only examined outcomes of births. There are varied estimates of how many pregnancies end in birth. In the US, about one-fifth of all pregnancies end in induced abortion (164). The rate of miscarriage is unclear, but it may be that 8-20% of women who know they are pregnant will have a miscarriage (165). An unknown number of women who do not know they are pregnant have undetected miscarriages very early. Women whose pregnancies end in birth do not represent all of the women who are pregnant. It is possible, then, that there is a reason to examine if social support, depressive symptoms, or other elements of mental health are associated with pregnancy outcomes overall.

Conclusion

We did not find associations between birth outcomes (LBW, PTB, and SGA) and measures of social support and depressive symptoms in a sample of racially diverse low-income clients receiving prenatal care in federally qualified health centers. Our findings are consistent with those of many other researchers, suggesting that either: (1) associations do not exist; or (2) our study, and many others, are not using exposure measures that are relevant for studies of birth outcomes.

Table 3.1 Sample description and association of prenatal depressive symptoms, social support and covariates with birth outcomes among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n= 2868)

	Total	Birthweight		Gestational age		Size for gestation	
		≥ 2500 grams (n=2654)	< 2500 grams (n=214)	≥ 37 weeks (n=2658)	< 37 weeks (n=210)	Average (n=2458)	Small (n=408)
Depressive symptoms and social support, %							
Depressive symptoms							
Low (PHQ-9 < 10)	83.9	84.3	78.9	83.8	84.6	84.3	81.4
Moderate/high (PHQ 10+)	16.9	15.7	21.1*	16.2	15.4	15.7	18.6
Social support							
Good	29.3	29.4	27.1	29.1	31.4	29.3	29.2
Moderate/poor	70.7	70.6	72.9	70.9	68.6	70.7	70.8
People to count on							
3+	66.1	66.4	63.1	66.2	65.7	66.5	63.7
2	19.5	19.3	21.0	19.2	22.4	19.6	19.0
0-1	14.4	14.3	15.9	14.6	11.9	13.9	17.3
People to take care of child(ren)							
3+	53.4	53.3	54.2	53.2	55.5	53.1	55.2
2	25.1	25.1	25.0	25.0	25.8	25.2	24.4
0-1	21.5	21.6	20.8	21.8	18.7	21.7	20.4
Partner support							
Good	79.0	79.5	72.4	79.2	76.2	79.6	75.1
No/low	21.0	20.5	27.6*	20.8	23.8	20.4	24.9*
Friend support							
Good	83.3	83.7	78.0	83.6	80.0	16.3	18.7
No/low	16.7	16.3	22.0*	16.4	20.0	83.7	81.3
Covariates, %							
Age							
< 20	31.0	30.8	34.3	30.9	33.3	29.7	38.8
20-24	37.3	37.7	32.4	37.7	32.4	37.8	34.6
25+	31.7	31.5	33.3	31.5	34.3	32.5	26.5***
Race							
African American	43.5	42.7	54.2	43.4	44.8	41.9	53.8
Asian/Pacific Islander	20.5	21.0	15.0	20.8	17.6	20.0	24.0
Hispanic	15.9	16.4	9.8	16.1	13.3	17.3	7.4
American Indian	12.1	12.1	12.6	12.0	13.8	12.6	8.9
White/ multiple	7.9	7.9	8.4**	7.7	10.5	8.3	5.9***
Foreign born	36.9	37.9	25.4***	37.3	32.1	38.2	29.0***
Marital status							
Married	24.9	25.6	16.4	25.5	17.7	25.5	21.6
Single, living with father of baby	18.2	18.3	17.4	18.2	18.2	18.1	18.9

Single, NOT living with father of baby	56.8	56.1	66.2**	56.3	64.1*	56.4	59.6
Parity							
No prior births	45.9	45.6	49.5	45.6	49.0	44.1	57.0
1 or more prior births	54.1	54.4	50.5	54.4	51.0	55.9	43.0***
Alcohol Use							
No/low	78.3	78.7	73.4	78.5	75.7	78.7	76.0
Moderate/high	21.7	21.3	26.6	21.5	24.3	21.3	24.0
Drug use							
No	77.2	77.3	75.2	76.9	80.0	77.8	73.3
Yes (prenatal or pre-pregnancy)	22.8	22.7	24.8	23.1	20.0	22.2	26.7*
Cigarette use							
No/low	75.1	75.8	66.8	75.5	70.3	75.8	70.5
Moderate/high	24.9	24.2	33.2**	24.5	29.7	24.2	29.5*
Any abuse or fear of abuse							
No	86.3	86.5	83.5	86.3	86.1	86.5	84.9
Yes	13.7	13.5	16.5	13.7	13.9	13.5	15.1
Phone access							
Good	89.8	89.7	91.6	89.7	91.4	90.1	88.2
Moderate/poor	10.2	10.3	8.4	10.3	8.6	9.9	11.8
Transportation access							
Good	52.9	53.5	45.3	53.5	45.2	53.8	47.9
Moderate/poor	47.1	46.5	54.7*	46.5	54.8*	46.2	52.1*
Food insecurity							
No/low insecurity	67.5	68.0	61.2	67.7	65.2	68.1	64.5
Moderate/ high insecurity	32.5	32.0	38.8*	32.3	34.8	31.9	35.5
Housing stability							
Stable	50.4	51.0	42.5	50.8	44.8	50.9	47.3
Unstable	49.6	49.0	57.5*	49.2	55.2	49.1	52.7
Number of environmental risks							
0	26.7	27.3	18.7	27.2	20.0	27.2	23.8
1	29.7	29.8	28.5	29.6	31.0	30.3	26.2
2-4	43.6	42.8	52.8**	43.2	49.0	42.5	50.0*

Chi-square distribution within birth outcome categories are significantly different: *p < .05; **p < .01; ***p < .0001.
Small for gestational age defined as infant weight < 10th percentile for gestational age (124).

Table 3.2 Prevalence of birth outcomes for study sample and stratified by birth outcomes among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 2868)

Birth outcome, %	Low birthweight (n = 214)	Preterm (n = 210)	Small for gestational age (n = 408)	Total (n = 2868)
Birthweight				
< 2500 grams	100.0	67.6	26.0	7.5
≥ 2500 grams	0.0	32.4	74.0	92.5
Gestational age				
< 37 weeks	66.4	100.0	8.3	7.3
≥ 37 weeks	33.6	0.0	91.7	92.7
Size for gestation				
< 10th percentile	50.0	16.3	100.0	14.2
11-100th percentile	50.0	83.7	0.0	85.8

Small for gestational age defined as infant weight < 10th percentile for gestational age (124).

Table 3.3 Comparison of mean birthweight and gestational age by depression and social support measures among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 2868)

	Birthweight (grams)	**Gestational age (weeks)**
Depressive symptoms	mean (sd)	mean (sd)
Low (PHQ-9 < 10)	3235 (559)	39.0 (2.1)
Moderate/high (PHQ 10+)	3212 (535)	38.9 (1.8)
Social support		
Good	3225 (552)	38.9 (2.1)
Moderate/poor	3233 (556)	39.0 (2.0)
Partner support		
Good	3246 (545)	39.0 (2.0)
No/low	3170 (590)*	38.8 (2.3)
Friend support		
Good	3237 (549)	39.0 (2.0)
No/low	3198 (583)	38.8 (2.2)

T-test comparison of means significantly different *p < .01.

Table 3.4 Univariate and multivariate regression models for LBW among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n= 2868)

	Unadjusted models		Adjusted model	
	OR	**CI**	**OR**	**CI**
Depressive symptoms and social support				
Prenatal depressive symptoms				
Low (PHQ-9 < 10)	Ref		Ref	
Moderate/high (PHQ 10+)	1.43*	(1.02, 2.03)	1.10	(0.76, 1.59)
Partner support				
Good	Ref		Ref	
No/low	1.48*	(1.08, 2.02)	1.16	(0.82, 1.63)
Friend support				
Good	Ref		Ref	
No/low	1.45I*	(1.03, 2.03)	1.32	(0.92, 1.88)
Covariates				
Race				
African American	Ref		Ref	
Asian/Pacific Islander	0.56*	(0.37, 0.84)	0.79	(0.50, 1.24)
Hispanic	0.47*	(0.29, 0.76)	0.65	(0.38, 1.11)
American Indian	0.82	(0.53, 1.28)	0.72	(0.45, 1.14)
White/multiple	0.84	(0.50, 1.41)	0.79	(0.46, 1.36)
Foreign born				
Yes	Ref			
No	1.80*	(1.31, 2.47)	1.29	(0.86, 1.94)
Marital status				
Married	Ref			
Single, living with father of baby	1.48	(0.92, 2.39)	1.10	(0.65, 1.84)
Single, NOT living with father of baby	1.84*	(1.26, 2.70)	1.19	(0.76, 1.88)
Cigarette use				
No/low	Ref			
Moderate/ high	1.55*	(1.15, 2.09)	1.23	(0.88, 1.73)
Number of environmental risks				
0	Ref			
1	1.40	(0.93, 2.11)	1.26	(0.83, 1.91)
2-4	1.80*	(1.24, 2.61)	1.38	(0.92, 2.06)

All variables in Table 1 were considered for inclusion in the multivariate model. Final adjusted model includes all variables significant (p <.05) in unadjusted analyses.

*p < .05

Table 3.5 Univariate and multivariate regression models for PTB among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 2868)

	Unadjusted models		Adjusted model	
	OR	**CI**	**OR**	**CI**
Depressive Symptoms and Social Support				
Low (PHQ-9 < 10)	Ref		Ref	
Moderate/High (PHQ 10+)	0.94	(0.64, 1.39)	0.77	(0.51, 1.16)
Partner support				
Good	Ref		Ref	
No/Low	1.19	(0.85, 1.66)	1.05	(0.73, 1.50)
Friend support				
Good	Ref		Ref	
No/Low	1.27	(0.89, 1.81)	1.27	(0.88, 1.83)
Covariates				
Marital Status				
Married	Ref		Ref	
Single, living with father of baby	1.44	(0.90, 2.29)	1.43	(0.89, 2.29)
Single, NOT living with father of baby	1.64*	(1.13, 2.39)	1.55*	(1.05, 2.30)
Lack of Transportation Access				
Good (low)	Ref		Ref	
Moderate or Poor	1.59*	(1.10, 2.30)	1.33	(1.00, 1.79)

All variables in Table 1 were considered for inclusion in the multivariate model. Final adjusted model includes all variables significant ($p < .05$) in unadjusted analyses.

*$p < .05$

Table 3.6 Univariate and multivariate regression models for SGA among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n= 2868)

	Unadjusted models		Adjusted model	
	OR	**CI**	**OR**	**CI**
Depressive symptoms and social support				
Prenatal depressive symptoms				
Low (PHQ-9 < 10)	Ref		Ref	
Moderate/high (PHQ 10+)	1.23	(0.93, 1.61)	1.09	(0.80, 1.46)
Partner support				
Good	Ref		Ref	
No/low	1.30*	(1.01, 1.66)	1.12	(0.86, 1.47)
Friend support				
Good	Ref		Ref	
No/low	1.18	(0.90, 1.55)	1.09	(0.82, 1.45)
Covariates				
Age				
< 20	Ref		Ref	
20-24	0.70*	(0.55, 0.90)	0.91	(0.69, 1.19)
25+	0.63*	(0.48, 0.82)	1.04	(0.75, 1.45)
Race				
African American	Ref		Ref	
Asian/ Pacific Islander	0.93	(0.72, 1.21)	1.28	(0.94, 1.73)
Hispanic	0.33*	(0.23, 0.50)	0.46*	(0.29, 0.71)
American Indian	0.55*	(0.38, 0.80)	0.51*	(0.35, 0.76)
White/multiple	0.56*	(0.36, 0.87)	0.52*	(0.33, 0.82)
Foreign born				
Yes	Ref		Ref	
No	1.52*	(1.21, 1.91)	1.26	(0.94, 1.69)
Parity				
No prior births	Ref		Ref	
1 or more prior births	0.59*	(0.48, 0.73)	0.62*	(0.48, 0.80)
Cigarette use				
No/low	Ref		Ref	
Moderate/high	1.31*	(1.04,1.66)	1.31	(1.00, 1.73)
Drug use				
No	Ref		Ref	
Yes (prenatal or pre-pregnancy)	1.28*	(1.01, 1.62)	1.05	(0.79, 1.39)
Number of environmental risks				
0	Ref		Ref	
1	0.99	(0.74,1.33)	0.94	(0.69, 1.28)
2-4	1.34*	(1.04, 1.75)	1.18	(0.88, 1.58)

All variables in Table 1 were considered for inclusion in the multivariate model. Final adjusted model includes all variables significant ($p < .05$) in unadjusted analyses.

Small for gestational age defined as infant weight < 10th percentile for gestational age (124)

* $p < .05$

Chapter 4: Manuscript #3 - An examination of prenatal and postpartum depressive symptoms among women served by urban community health centers.

This manuscript is published. Citation below:

AC Sidebottom, WL Hellerstedt, PA Harrison, D Hennrikus. (2014). An Examination of prenatal and postpartum depressive symptoms among women served by urban community health centers. *Archives of Women's Mental Health*; 7 (1): 27-40 (published online ahead of print September 2013*).* DOI: 10.1007/s00737-013-0378-3

SUMMARY

Objective. We characterized depressive symptoms in the prenatal and/or postpartum periods and examined associated risk factors among 594 women who received care at community health care centers.

Methods. Women were screened with comprehensive risk assessments, which included the Patient Health Questionnaire-9 (PHQ-9) depression screen, during pregnancy and at least four weeks after delivery.

Results. Fifteen percent had depressive symptoms in the prenatal period only; 6% in the postpartum period only; and 8% had depressive symptoms in both periods. Risk markers varied for women who reported depressive symptoms at one period only compared to those who reported persistent depressive symptoms. Age (25 years vs. younger), having experienced abuse, not living with the infant's father, and cigarette smoking were associated with depressive symptoms at both periods; being US-born, lacking social support, and experiencing food insecurity were associated with reporting symptoms only in the prenatal period; and lack of phone access was associated with risk only in the postpartum period.

Conclusions. Our findings confirm the importance of repeated screenings for depressive symptoms during the perinatal period. The variability in risk markers associated with periods of reported depressive symptoms may reflect their varying associations with persistence, new onset, or recovery from depressive symptoms.

INTRODUCTION

In recent years, the media and the public health community have focused much attention on postpartum depression. As a result, screening to identify postpartum depression has become more widely promoted (30, 62, 63). While there has been less attention focused on prenatal depression, there is a growing body of literature aimed at understanding how prenatal and postpartum depression are associated and identifying risk factors for depression during these periods. A better understanding of prenatal and postpartum depression prevalence, timing of onset, and the persistence or improvement of symptoms could inform health care and public health guidelines for screening and support services.

Prenatal and postpartum depression each have unique and serious risks. Prenatal depression is associated with pre-eclampsia, neonatal growth retardation, spontaneous abortion, and delivery of preterm and low birthweight infants (15, 30, 118, 166). Its association with poor fetal growth could explain the limited evidence that it is adversely associated with infant cognitive, behavioral, and psychomotor development (167). Postpartum depression may limit a new mother's capacity to fulfill her maternal role. Infants of women experiencing postpartum depression are at increased risk for poor bonding, cognitive and emotional developmental delays, and behavior problems as children (30, 167). These pregnancy, fetal, and infant development risks associated with prenatal and postpartum depression highlight the need to better understand depression during these time periods to inform screening, treatment, and prevention efforts.

Several prospective studies conducted in a variety of countries provide some evidence about the prevalence of depression during pregnancy and postpartum (10, 64-71, 168-170). These studies found a wide range in prevalence rates and most reported higher prevalence in pregnancy than in the postpartum (10, 64-66, 68-71, 168) while others found similar prevalence rates in both time periods (67, 169, 170).

To guide practice and public health efforts, it may be helpful to understand both the onset of symptoms and the persistence of those symptoms. Some research on the prevalence of depression has focused on postpartum-onset depression as compared to postpartum depression that began prenatally (66, 69-71). Prospective studies have generally found that prenatal-onset depression is more common than postpartum onset (10, 64-72). Several studies have provided evidence that prenatal depression may persist into the postpartum period and that perhaps half of "postpartum depression" had its onset prenatally (10, 65). For example, the Avon Longitudinal Study reported that 8.9% of women had elevated depression scores postpartum but only 3.5% were new cases (68). Similarly, in a Canadian study of 360 women, 6.8% had a postpartum depression diagnosis but only half (3.4%) experienced the onset of depression during the postpartum period (69). A few studies have also examined not only the persistence of prenatal depressive symptoms into the postpartum, but what they label "recovery." A study of 41 women with elevated prenatal depressive symptoms found that, in the postpartum, 39% "recovered" to non-elevated levels and 61% had persistent elevated symptoms (72). A larger study (n = 1019) of urban Brazilian women found that 47% of the women who had depression during pregnancy also had depression postpartum (71).

There are few studies about how the risk markers for depressive symptoms may differ for the prenatal or postpartum periods, or how they may be associated with the persistence or "recovery" from prenatal depressive symptoms (66, 69-71). Several personal, social, behavioral and environmental factors may be related to experiencing depression during either or both the prenatal or postpartum periods. Previously identified independent risks for prenatal or postpartum depression include maternal anxiety, life stress, or history of depression (171, 172), abuse (173, 174), lack of social support, social isolation (171, 174, 175), lower education, being unmarried or in a poor relationship quality, unintended pregnancy, smoking (171, 172), and poverty (10, 171, 173). Alcohol and drug use are associated with general depression (176), postpartum depression (177) and have had inconsistent findings related to prenatal depression (171). Studies that have examined risk during both the prenatal and postpartum periods have found some risks may be associated with recovery from depression experienced prenatally (66, 72) such as living with a partner, lower baseline depressive symptoms. Another found that some risks associated with prenatal depression (e.g., age and number of children), are not associated with postpartum onset (69). While the risk markers for depressive symptoms experienced in the postpartum period and to a lesser degree, prenatally are clear, the characteristics of women who "recover" from prenatal depressive symptoms after giving birth are relatively unexplored. Previously conducted studies provide some evidence through small sample sizes or a limited set of risk factors. More detailed examination of the experience of depressive symptoms perinatally is needed because of its impact on maternal and infant health and because risk markers may be modifiable.

The goals of this study were to: 1) describe elevated depressive symptom levels in pregnancy and postpartum and characterize the timing of detection and persistence or recurrence of symptoms in a sample of women who received care at urban community health clinics; and 2) examine personal, social, behavioral, and environmental correlates of elevated depressive symptom levels in pregnancy only, postpartum only, or during both periods. Our analyses were informed by the Theory of Triadic Influences (73). The theory was designed to assist researchers in identifying intervention approaches and posits that broad categories of personal, social and environmental factors influence health outcomes.

METHODS

Study Overview and Context

This study was conducted through the Twin Cities Healthy Start program, one of 105 programs funded through the United States' Healthy Start Initiative by the Health Resources and Services Administration. The United States' Healthy Start Initiative targets funding to communities with high rates of infant mortality. The Twin Cities Healthy Start Program covered specific geographic communities in Minneapolis and St. Paul in Minnesota, USA. It served primarily African Americans and American Indians, the two groups with the highest long-term rates of infant mortality locally and statewide in Minnesota (87). The local program, administered by the Minneapolis Department of Health, offered outreach and case management services to women who received prenatal care at Federally Qualified Health Centers (FQHCs). FQHCs are typically located in -

and serve - medically underserved communities that are home to disproportionate numbers of families living in poverty.

As part of the local Healthy Start program protocol, all women who sought prenatal care at participating FQHCs were screened using a multidimensional screening instrument developed for the program (88) which includes the Patient Health Questionnaire-9 (PHQ-9) depression screen. Women who were enrolled in the Twin Cities Healthy Start program were also screened during the postpartum period a similar assessment that also included the PHQ-9.

The University of Minnesota Institutional Review Board approved the use of data from the Twin Cities Healthy Start program for the study analyses.

Study Sample

The study sample was women who sought prenatal care at five FQHCs and who enrolled in the Twin Cities Healthy Start program between November 2005 and May 2009. Women were included in this study if they completed both the prenatal and postpartum screenings. Postpartum data were not collected for women who transferred care to another clinic during pregnancy.

Of the 1,822 women enrolled in the program during the study period, 728 had both prenatal and postpartum screening data available. The postpartum risk assessment protocol required waiting until at least four weeks post-delivery because earlier

symptoms might represent the initial “baby blues” period (178). However, some postpartum screenings occurred earlier because case managers believed they would not be able to meet with or reach a woman later to conduct the interview because of a previous history of missed appointments. Women (n=119) whose postpartum screening was conducted before four weeks postpartum were excluded from the study. An additional 15 women were excluded because they were missing information on the timing of their postpartum screening. The final sample consisted of 594 women (33% of those enrolled).

Data Collection

The prenatal assessment was conducted at the end of the prenatal intake appointment, which included a substantial discussion of medical history. The risk assessment interview, lasting 10-15 minutes, was usually conducted by a registered nurse but sometimes by a social worker or a community health worker. As the interviewer administered the assessment, she entered responses into the web-based Twin Cities Healthy Start Screening and Case Management System, which linked to other databases with individual demographic descriptors, service-related information, and birth outcomes (88). The postpartum assessment was conducted when the woman was at the clinic for another purpose, with the goal of administering assessment between four and 12 weeks after delivery. In some cases when clinic staff members were unable to meet with the woman in person, they conducted the postpartum interview by telephone.

Measures

The Prenatal Risk Overview (PRO) (Appendix A), the prenatal risk assessment instrument developed for the program consists of 58 questions that address 13 domains: telephone access, transportation access, food security, housing stability, social support, partner violence, physical/sexual abuse by a non-partner, depressive symptoms (i.e., the PHQ-9), cigarette smoking, alcohol use, drug use, legal problems, and child protection involvement. This instrument has been described in detail previously (88). A shortened version of the PRO, which also includes the full PHQ-9, was used to assess risks in the postpartum period (PPRO) (Appendix B). The criterion validity of the alcohol, drug, and depression domains was established against the Structured Clinical Interview for DSM Disorders (SCID), a structured diagnostic interview (89-91). All three domains were found to have high sensitivity and specificity. Re-screening and interviewer equivalence studies have also been conducted (88, 89).

Depressive symptoms (PHQ-9)

The PHQ-9, which is included in the PRO (Appendix A) and PPRO (Appendix B), was developed using diagnostic criteria to screen for depression in a general primary care patient population (95, 179). The PHQ-9 has been shown to have acceptable validity in diverse patient populations (91, 94, 95, 125-130, 179, 180), including obstetrics-gynecology patients (95), postpartum (180-182), and pregnant women (91). A meta-analysis of PHQ-9 diagnostic accuracy studies estimated a sensitivity of 77% for major depressive disorder, specificity of 94%, and a positive predictive value of 59% in primary care populations and higher (85-90%) in populations with a high prevalence of depressive disorder (94). A study of postpartum women (180) yielded 82% sensitivity and 84%

sensitivity. A prenatal validation of the PHQ-9 was conducted in a subset of community health clinics participating in the Twin Cities Healthy Start program. This study, with a sample similar to that of the current study, compared the prenatal PHQ-9, administered as part of the PRO, to a structured diagnostic interview and found sensitivity of 85% and specificity of 84% for major depressive disorder (91). In studies assessing the concordance of the PHQ-9 with the Edinburgh Postnatal Depression Scale, another widely used depression screening tool, the two instruments performed similarly in the postpartum and prenatal periods (183, 184).

PHQ-9 questions address the previous two weeks and ask about physical and mood symptoms of depression: problems sleeping, being tired or having little energy, appetite, restlessness, speaking or moving slowly, feeling little interest or pleasure, feeling down or hopeless, feeling bad about yourself, and suicidal ideation. We made one modification: the item measuring psychomotor retardation (moving or speaking slowly) or agitation (being fidgety or restless) was split into two questions to examine these symptoms separately, but were scored as one item. Response categories for all questions were: “not at all”, “several days”, “more than half the days”, and “every day or nearly every day”. Each item was scored from 0 (“not at all”) to 3 (“every day or nearly every day”) and the item scores were summed. We created the following categories to reflect depressive symptom severity (95): scores less than 10 as low, 10-14 as moderate, 15-27 as high. In this study, a dichotomous measure was also used for low (< 10) or moderate/high (10+) to categorize postpartum depressive symptom levels as the dependent measure in regression models. The cut point of 10 corresponds to the score at which providers

recommend the development of a treatment plan for counseling, follow up and/or pharmacotherapy (96). A measure combining pregnancy and postpartum PHQ-9 scores was created to identify when depressive symptoms were reported resulting in the following categories: low (prenatal and postpartum PHQ-9 scores both < 10), prenatal only (prenatal PHQ-9 $\geq$ 10 and postpartum PHQ-9 < 10), postpartum only (prenatal PHQ-9 < 10 and postpartum PHQ-9 $\geq$ 10), and prenatal and postpartum (PHQ-9 scores $\geq$ 10 at both time periods).

Social, Behavioral, and Environmental Factors

These measures came from the PRO (Appendix A) and were scored as low, moderate, and high risk categories as described elsewhere (88). For analyses, we dichotomized each domain as low or moderate /high levels risk; scoring definitions are described below.

Social Factors

To assess lack of social support, six items from the 21-item Maternal Social Support Index (97) were used. The questions asked about how many people a woman could count on in times of need or to take care of children for several hours, relationship satisfaction with boyfriend/husband/partner and with other adults. Risk was scored as moderate/high if a woman indicated she had no one or only one person to count on in times of need or to take care of children for several hours; if she had no husband/ partner, or had a partner but had unsatisfactory communication with him; or if she had satisfactory communication with a husband/boyfriend or another adult but not both. Risk was scored low if a woman

had more than one person to take care of her children or to count on in times of need and satisfactory communication with both a husband/partner and an adult.

Six violence items, scored yes/no, adapted from the Abuse Assessment Screen (100), asked about two time periods: 12 months prior to pregnancy awareness and the interval since pregnancy awareness. The questions asked about experiencing abuse, forced sex, fear of being abused relative to an intimate partner and repeated to apply to anyone else. Risk was scored moderate/high if a woman indicated abuse during pregnancy or prior to pregnancy, or current fear of abuse. Risk was scored low if she denied abuse for both time periods. We combined responses about the two sources of abuse (i.e., intimate partner or someone else) into a single measure of any abuse. This combined measure was coded as low for women who reported no abuse by anyone during both of the time periods and moderate/high if she reported abuse from anyone during pregnancy or prior to pregnancy, or if she feared current abuse.

Child protection involvement was assessed with a single question about current or previous involvement with the child protection system (as a parent). Risk was scored moderate/high if the woman reported current or previous involvement.

Behavioral Factors

Smoking, alcohol and drug use quantity and frequency questions were from the National Household Survey on Drug Use and Health (NHSDUH) (98). Two time frames were addressed for each question: before pregnancy awareness (one month for smoking and 12

months for alcohol and drug use) and after pregnancy awareness. Smoking was assessed with two questions for each time period: frequency (i.e., daily, less than daily, not at all) and average number of cigarettes smoked per day. If she smoked during pregnancy or was a daily smoker prior to pregnancy awareness she was coded as moderate/high risk. If she did not smoke during either period or smoked prior to pregnancy awareness less frequently than daily, then she was coded as No/Low risk.

In addition to the frequency and quantity questions, the alcohol measure included consequence questions from the Rapid Alcohol Problem Screen (RAPS4) (99). These questions asked about having a feeling of guilt after drinking, being told about things they did while drinking they could not remember, neglecting responsibilities because of alcohol use, or drinking in the morning. Alcohol scoring was based on frequency, quantity, consequences. The moderate/high risk was defined as any alcohol drinking after pregnancy awareness, or experiencing any adverse consequences related to drinking prior to pregnancy awareness, or a typical pattern of drinking in the year before pregnancy awareness of 2 or more drinks daily, 3 drinks per occasion once per week or more frequently, or 4 drinks per occasion once per month or more frequently. No/ Low risk was defined for women reporting no use after pregnancy awareness and no adverse consequences prior to pregnancy awareness, and either no alcohol use prior to pregnancy awareness or typical use in the year prior to pregnancy awareness of 1 drink at any frequency level, 2 drinks on a single occasion at a weekly or monthly frequency or 3 drinks on a single occasion monthly or rarely. The PRO identified an alcohol use disorder

as measured by the Structured Clinical Interview for DSM Disorders (SCID) with sensitivity of 84% and specificity of 80% (89).

Drug use scoring was based on frequency (i.e., daily, weekly, monthly, rarely, never) and on the response to one drug use consequence question (i.e., neglected responsibilities because of drug use) prior to pregnancy awareness and on frequency of use since pregnant. Moderate/high risk was defined as any drug use before or since pregnancy awareness or a history of failed obligations associated with drug use before pregnancy awareness. Low risk was defined as no use reported in either time period and no history of failed obligations associated with drug use. The PRO identified a drug use disorder as measured by the SCID with sensitivity of 89% and specificity of 74% (90).

Environmental Factors

Lack of access to telephone and transportation questions were developed specifically for the PRO and were assessed with one question each: When you are at home, how often do you have access to a telephone?, How often do you have access to transportation?. Moderate/high risk for each question was defined as responses of “none”, “rarely”, and “some of the time”. Low risk was defined as a response of “all of the time”.

Food insecurity was measured with four items adapted from the 12-month Food Security Scale of the U.S. Census Current Population Survey (103). The four items, scored 0-2, asked (1) how often food ran out and the woman did not have money to buy more; whether the woman could afford to eat balanced meals; whether the woman cut the size

of a meal or skipped meals; and whether the woman had been hungry but unable to buy food. Responses to each question were “often”, “sometimes,” or “never”. We created a summary score and classified a score between 0 and 2 as low risk and between 3 and 8 points as moderate/high risk.

Housing instability was assessed with four questions, one from the Homeless Supplement to the Diagnostic Interview Schedule (102) and the others generated by clinic staff to reflect situations their clients experienced. The questions asked how many months out of the prior year a woman lived with family or friends as a temporary situation, how many nights out of the prior year she stayed in a shelter, how stable she felt her current housing situation was, and how concerned she was she would not have a place to live when her baby was born. Women were classified as moderate/high if they lived with family or friends as a temporary situation for three or more months in the past year; stayed in a shelter for one or more nights; described their current situation as unstable, and/or were very or somewhat concerned about not having a place to live when their infant was born. Women who did not stay in a shelter, were not concerned about having a place to live, and who stayed with relatives or friends for less than three months or not at all were classified in the low category.

Personal and Clinical Characteristics

Race/ethnicity was recorded as mutually exclusive categories: African American, American Indian, Asian/Pacific Islander, Hispanic (any race), white, or bi/multiracial. Nativity was categorized as U.S.-born or foreign-born. Marital status was categorized as

unmarried or married. Whether women were living with the father of the infant at prenatal intake was also recorded. While measures were available for both marital status and whether the woman was living with the father of the infant, we used only "living with the father of the infant" in regression models because only 16% of the women reported being married, while 32% reported living with the father of the infant. Trimester of pregnancy at initial PRO administration was calculated based on interview date and due date (or last menstrual period if due date was not entered), and categorized into first (1-13 weeks), second (14-26 weeks), or third (27+ weeks) trimester. Age was calculated based on date of birth and date of prenatal intake.

Analysis

We conducted statistical analyses with SPSS 18.0 (2010). We used frequency distributions to describe the study sample and depressive symptom levels. We conducted chi-square tests to examine differences between women included and excluded from the study sample and to examine correlates of elevated depressive symptom levels in pregnancy only, pregnancy and postpartum, and postpartum only. We compared mean PHQ-9 scores for the prenatal and postpartum periods using a t-test for paired samples. We conducted multinomial logistic regression to examine adjusted associations of social, behavioral and environmental risk factors with categories of elevated depressive symptom level time periods, with low symptom levels in both time periods as the reference. The reference categories for risk factors used in regression models were selected because of their association with low risk for depression.

RESULTS

Included and excluded women differed significantly on four of the 18 factors collected at the time of the initial PRO (Table 4.1). Excluded women were more likely to be African American, Hispanic, or white and less likely to be American Indian or Asian. They were more likely than included women to have had their initial PRO conducted in the first trimester, to be smokers, and to report housing instability.

The study sample was young: 76% were younger than 25 years of age (mean 21.9, SD 5.45). Half were African American, 20% American Indian, and 16% were Asian. Nearly one-quarter were foreign born. The three largest immigrant groups were Hmong, Somali and Hispanic. Interpreters were used for only one-quarter of foreign-born women (6% of the study sample): 3.2% of the interviews were conducted in Hmong, 2.4% in Spanish and less than 1% in Somali or Laotian. A majority of women (84%) were unmarried and one-third (32.6%) were living with the father of the infant at the time of the prenatal intake appointment. The PRO was administered in the first trimester for 42% of women and the second trimester for 43%. Mean gestation at the time of the prenatal assessment was 17.2 weeks (SD 8.0). Eighty-four percent of postpartum assessments were completed within 4 to 12 weeks after the infant was born (67% were done in 4-8 weeks, 17.3% done in 9 – 12 weeks, and 15.7% were done after 12 weeks postpartum).

More women had elevated depressive symptom levels prenatally than postpartum: 10.8% versus 6.4% at high levels and 12.0% versus 7.6% at moderate levels, respectively (Table 4.2). The average PHQ-9 scores were consistent with the findings from categorical risk

classifications with a mean score of 6.06 (SD 5.86) prenatally and 3.78 (SD 5.57) postpartum, ($t = 9.532$, $p < 0.001$). Based on the combination of prenatal and postpartum PHQ-9 scores, 71.4 % had low depressive symptom levels at both points. Elevated levels were seen for 14.6% during the prenatal period only, 8.1% during both periods, and 5.9% during the postpartum period only. Thirty-six percent of those with elevated symptom levels prenatally also had elevated levels postpartum. Of the women with postpartum elevated depressive symptom levels, 58% had elevated levels in the prenatal period (Table 4.2).

With the exception of transportation access, all of the social, behavioral, and environmental risk correlates and personal characteristics examined were significantly associated with elevated depressive symptom levels (Table 4.3). All risk factors were least prevalent among women with low depressive symptom levels both during pregnancy and the postpartum. With the exception of lack of social support, higher proportions of women with elevated symptom levels during pregnancy and postpartum had social and behavioral risk factors than women in the other groups. Multinomial regression models examined adjusted associations for the risk factors that were significant in the cross tabulations, using low depressive symptom levels during both time periods as the reference group (Table 4.4). Experiencing abuse, not living with the father of the infant and smoking were all associated with increased odds of being in the group with elevated depressive symptom levels during both pregnancy and postpartum. The odds of having elevated depressive symptoms in both periods compared to low symptoms in both periods was 2.2 times higher for women experiencing abuse than those

not experiencing abuse, 2.8 times higher for those not living with the father of the infant compared to those who are, and 2.1 times higher for smokers compared to non-smokers. Women under the age of 25 were less likely than older women to report prenatal and postpartum depressive symptoms or symptoms in the prenatal period only compared to the low symptom group. The odds of experiencing elevated depressive symptom levels in the prenatal period only compared to the low symptom group were increased for women who were US born, lacked social support and were experiencing prenatal food insecurity. Specifically, compared to those with low depressive symptom levels in both periods, the odds of having elevated depressive symptoms in the prenatal period only was 2.6 times higher for women with poor social support compared to those with better social support and 2.4 times higher for women with moderate or high levels of food insecurity compared to those with low levels of food insecurity. Only one risk factor, lack of phone access, remained significantly associated with increased risk of experiencing elevated depressive symptom levels in the postpartum period only compared to the low symptom group.

DISCUSSION

Our examination of the prevalence of elevated depression symptom levels found a higher rate in pregnancy (23%) than in the postpartum period (14%). These findings are consistent with other prospective studies of prenatal and postpartum depression (64-67, 69-71, 168). For example, a study of over 9,000 women in Avon England found 13.5% with probable depression at 32 weeks gestation and 9.1% at 8 weeks postpartum (64), while a study of 192 low-income women found 41.7% with depression during pregnancy

and 23.4% with postpartum depression (10). Our finding that experiencing elevated symptom levels in the postpartum period only is the least likely scenario is also consistent with the Avon study (68).

Our findings that 29% of the study sample had elevated depressive symptom levels either prenatally or postpartum, with the majority of these cases detectable during pregnancy, support the practice of systematically screening all women in the prenatal and postpartum periods. Fifty-eight percent of women who had a PHQ-9 score in the postpartum period high enough to trigger a clinical treatment plan (96) also met that clinical cut off level during pregnancy. This finding is similar to other studies (10, 64, 65, 168). In one study (65), 11 (55%) of the 20 women with postpartum depression had been diagnosed during pregnancy. In a study of low-income US women, 53% of the 45 women with postpartum depression had prenatal onset (10).

We found that 64% of the women with elevated depressive symptom levels in the prenatal period exhibited symptom levels below the PHQ-9 score of 10 in the postpartum period. This rate of recovery or remission was higher than the 39% reported in a study of 41 women screened as depressed in their third trimester (72).

While we cannot assume a causal relationship, our findings of a higher prevalence of some behavioral, social and environmental risks among women with depressive symptoms during pregnancy suggest that prenatal interventions to address abusive relationships, food insecurity and social isolation might also decrease depressive

symptom levels. Only one of the risk factors examined at prenatal intake, lack of phone access, was significantly associated with postpartum onset of depressive symptoms. This measure is likely a proxy for extreme poverty and/or social isolation, which may become more problematic after childbirth. It should be noted that our regression model may have lacked sufficient power to detect some associations: the postpartum-onset sub-sample had only 35 women.

A few other studies have also examined correlates of depression or depressive symptoms in either the prenatal period, postnatal period or both periods, but they differ from our study in the selection of predictors and depressive symptom classifications. Some characteristics associated with postpartum recovery from prenatal depression included exercise, living with a partner (72), the absence of a history of psychiatric disorder (66), and lower prenatal depression scores (70). Persistent depressive symptoms through prenatal and postpartum were related to higher prenatal depression severity scores (72). Postpartum onset was associated with higher mean scores on their prenatal depression screening and reported higher perceived stress in pregnancy, lower marital satisfaction, greater use of “escape-avoidance” as a coping strategy, and more negative perceptions of the amount of caring they received from their own parents in one study (70). Another study (66) found a history of psychiatric disorder, being single, and obesity were associated with postpartum onset of depression.

Despite a variety of measures and different study samples, a common theme among prior studies and ours is the role of social support as measured by marital status, living with a

partner, or marital/partner satisfaction. We found that not living with the father of the infant was associated with increased odds of elevated symptom levels in both prenatal and postpartum periods. In addition to these relationship measures our social support composite measure was associated with increased depression in the prenatal-only group but not the other two depressive symptoms groups. Other studies have found associations for social support measures with postpartum depression (65, 168-170, 185). Our study may differ from these because our measure was of prenatal social support; a measure of postpartum social support may have been more predictive of postpartum depression. Additionally, the sample may have been too homogeneous with regard to lack of social support to detect a meaningful role for this measure within the sample.

Prenatal and postpartum depression have serious risks (15, 30, 118, 166, 167). Identifying women with elevated depressive symptom levels through screening is the first step in preventing poor outcomes. The convergence of study findings indicate that screening women early in pregnancy will identify a majority of women who will experience elevated depressive symptoms in the perinatal period. Earlier identification will enable both individual clinicians to better address individual needs as well as the health care system to better address by understanding risk levels in populations served. Increased screening will also allow for the ability to study the effect of interventions to address prenatal depression on the reduction of postpartum depression and poor outcomes related to depression during either period.

Limitations

Sample attrition was high (60%), but not surprising given other reports about attrition of low-income populations from prenatal and parenting public health programs and services (186, 187). Clinic-based samples, like ours, are valuable because they are likely to be more representative of the diversity of women served by public programs than are samples of women who are specifically enrolled in longitudinal research studies. Such women may be very distinct if they are recruited or enrolled because they have qualities that are associated with long-term compliance and adherence (e.g., expectation of low residential transience; literacy). Thus, attrition may be one of the costs of studying a socially vulnerable sample. Like others who have studied samples similar to ours (186, 188), we believe that much of the attrition in our sample was related to the high level of residential transience of our socially vulnerable sample. And, consistent with our program protocol, women with medically high-risk pregnancies were transferred from our clinic sites to hospital-based specialty clinics and were thus unavailable for postpartum follow-up. In addition, we excluded another 7% of the original sample because of data quality—another issue not as common in samples designed for research studies. We found few differences on a range of variables when we compared women who were included with those who were excluded from our study (Table 4.1). Three of the four characteristics where the groups demonstrated differences (i.e., race, housing stability, and tobacco use) were small differences and only one factor (tobacco use) was related to depressive symptoms. The fourth difference was that excluded women were more likely to have their prenatal screening done in the first trimester. This finding is consistent with attrition due to the transfer of care because women who know they are

medically at risk from past experience may have been more motivated to initiate care early.

Because our sample was predominantly urban women of diverse ethnic backgrounds who were served by Federally Qualified Health Centers, our findings may not be generalizable to populations who are more homogenous in terms of race, are of higher income, and/or are from rural areas. However, we have no evidence that our data are not generalizable. Our main finding—that the presence of depressive symptoms was higher in the prenatal period than the postpartum—is consistent with findings from other studies with diverse populations (10, 64-67, 69-71, 168). Many of the risk markers we identified for prenatal and/or postpartum depressive symptoms have also been reported by others (e.g., social support, experience of domestic violence) and our findings thus add to an already established body of literature. The high prevalence of markers of social vulnerability in our sample (e.g., identification with historically disenfranchised race groups, non-marital status) allowed us to examine a sample in whom public health programs have a high investment in serving. For example, we found that food insecurity—a potentially modifiable factor—was a risk marker for depressive symptoms. To our knowledge, few studies in developed countries have examined food insecurity in perinatal samples (189-194). We are aware of two studies, by the same study team, that have examined its association with prenatal depressive symptoms (195, 196). One of these two studies, a quantitative study with 135 subjects, reported that food insecurity was associated with an increased risk for prenatal depressive symptoms (adjusted odds ratio, 2.6; 95% confidence interval, 1.0, 6.5). Our findings were similar (adjusted odds ratio, 2.4; 95%

confidence interval, 1.4, 4.2) after adjustment for many more risk markers. We are aware of at least one study that also examined the association of food insecurity with postpartum depressive symptoms (191) and found a slight association (adjusted Relative Risk, 1.09; 95% CI: 1.02 to 1.16), consistent with our findings of no association with more comprehensive adjustment. Our study extended knowledge about food insecurity by showing that it was not associated with depressive symptoms at both time periods. Furthermore, our disproportionately socially vulnerable sample allowed us to identify a risk marker for postpartum depressive symptoms—lack of phone access—that may serve as a simple and valid marker of economic risk in future studies with similar samples.

The measures of depressive symptoms were collected only at two points, once at entry into prenatal care and again about 4 to 12 weeks after delivery. We used these two measurement time points to describe depressive symptom status for the prenatal and postpartum periods, without information on how those symptoms potentially fluctuated during the time between measures. For example, women with high scores in both periods could have been experiencing persistent symptoms throughout or may have had a recovery and recurrence postpartum of those symptoms. Similarly, women who had high scores in the prenatal period but not in the postpartum may have represented a recovery from depressive symptoms or a remission period followed by recurring symptoms. While imperfect, the methodology to use measures at these time points as a proxy for the prenatal or postpartum period is similar to methods used in other studies.

This study was limited to risks measured during the prenatal period. Future examination of simultaneous measures of risk and depressive symptoms postpartum may provide additional evidence of the importance of the timing of measures and may yield stronger associations with postpartum onset of depressive symptoms. We did not include some measures previously identified as associated with postpartum depression, such as pre-pregnancy psychiatric diagnosis or pregnancy intention (171), which may be useful in future examinations.

Conclusion

Our study found elevated depressive symptoms more common prenatally than postpartum**.** We found nearly one-fourth of prenatal clients scored at 10 or higher on the PHQ-9 at either time period which warrants a mental health assessment or treatment plan. Improved prenatal screening efforts would not only identify women earlier but allow more time to intervene to improve their health and ability to parent as well as to protect against poor birth outcomes associated with depressive symptoms. The finding that some women experience depression only in the prenatal period and some experience it persistently, suggests that aggressive intervention prenatally has the potential to reduce risk for postpartum depression. This study identified several social, behavioral, and environmental risk markers associated with depressive symptoms in the prenatal period only and during both prenatal and postpartum period. How these risks and related interventions may be related to "recovery" warrants further research. Additionally, further research is needed related to postpartum-specific changes or development of risk markers that could be related to postpartum onset.

Table 4.1. Comparison of Study Sample with Women Excluded Due to Missing Postpartum Data among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 1822)

Personal Characteristics	Total (n = 1822) %	Women Excluded (n = 1228) %	Final Study Sample (n = 594) %	P-value
Age				
< 20	38.3	37.6	39.6	
20-24	34.9	34.0	36.6	0.115
25+	26.9	28.4	23.8	
Race/ Ethnicity				
African American	52.5	53.4	50.5	
Asian/Pacific Islander	13.6	12.4	16.0	
Hispanic	9.2	9.9	7.7	0.005
American Indian	17.1	15.7	20.2	
White	5.0	5.5	3.9	
Multiple	2.6	3.1	1.7	
Foreign Born				
Yes	23.9	23.5	24.8	0.523
No	76.1	76.5	75.2	
Trimester PRO conducted				
1st	48.6	51.5	42.8	
2nd	39.7	38.1	43.0	0.001
3rd	11.7	10.4	14.3	
Prenatal Depressive Symptom Level (PHQ-9)				
Low (< 10)	77.8	78.0	77.3	
Moderate (10 - 14)	12.6	12.9	12.0	0.473
High (15-27)	9.6	9.1	10.8	
Social Factors				
Lack of Social Support				
Low	22.5	23.2	20.9	0.260
Moderate/ High	77.5	76.8	79.1	
Intimate Partner Violence				
No	89.5	89.1	90.2	0.461
Abuse or Fear of Abuse	10.5	10.9	9.8	
Abuse by Someone Else				
No	87.3	87.3	87.4	0.998
Abuse or Fear of Abuse	12.7	12.7	12.6	
Child Protection involvement				
No	85.8	85.0	87.5	0.156
Yes (prior or current)	14.2	15.0	12.5	
Marital Status				
Married	15.0	14.5	16.0	0.415
Single	85.0	85.5	84.0	
Living with father of the baby				
Yes	32.6	32.8	32.2	
No	67.4	67.2	67.8	0.777

Table 4.1. Comparison of Study Sample with Women Excluded Due to Missing Postpartum Data among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 1822)

	Total (n = 1822)	Women Excluded (n = 1228)	Final Study Sample (n = 594)	
Behavioral Factors				
Alcohol Use				
Low or No pre-pregnancy use/ No Prenatal Use	70.8	70.0	72.6	0.257
Any Prenatal or High Pre-pregnancy Use	29.2	30.0	27.4	
Drug Use				
No	65.0	63.8	67.5	0.127
Yes (Prenatal or Pre-pregnancy)	35.0	36.2	32.5	
Cigarette Use				
No Prenatal/ No or < daily Pre-pregnancy	65.4	63.4	69.4	0.013
Any prenatal use or daily pre-pregnancy	34.6	36.6	30.6	
Environmental Factors				
Lack of Phone Access				
Low	87.6	87.1	88.6	0.386
Moderate/ High	12.4	12.9	11.4	
Lack of Transportation Access				
Low	42.2	42.9	40.7	0.389
Moderate/ High	57.8	57.1	59.3	
Food Insecurity				
Low	57.7	57.2	58.7	0.539
Moderate/ High	42.3	42.8	41.3	
Housing Instability				
Low	33.5	31.8	37.2	0.021
Moderate/ High	66.5	68.2	62.8	

Table 4.2. Prenatal and postpartum depressive symptom levels among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 594)

	Postpartum Depressive Symptom Level (PHQ-9)				
Prenatal Depressive Symptom Level (PHQ-9 score)	Low (< 10)	Moderate (10 - 14)	High (15-27)	**Total**	
Low (< 10)	424	22	13	459	77.3%
Moderate (10 - 14)	51	12	8	71	12.0%
High (15-27)	36	11	17	64	10.8%
Total	511	45	38	594	
	86.0%	7.6%	6.4%		

Combined classifications in prenatal and postpartum periods		
Low both periods	424	71.4%
Prenatal only	87	14.6%
Prenatal and postpartum	48	8.1%
Postpartum only	35	5.9%
Total	594	

Table 4.3. Association of personal, social, behavioral, and environmental factors with elevated depressive symptom levels among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 594)

	Prenatal and Postpartum (n = 48)	Prenatal only (n = 87)	Postpartum only (n = 35)	Low (both periods) (n = 424)	P-value
Personal Characteristics					
Age					
25+	37.5	35.6	22.9	19.9	0.002
< 25	62.5	64.4	77.1	80.1	
Race/ Ethnicity					
Asian/Pacific Islander	6.3	12.6	5.7	18.6	0.039
African American	54.2	62.1	57.1	47.2	
American Indian	29.2	13.8	28.6	19.8	
Hispanic, White, or Multiple	10.4	11.5	8.6	14.4	
Foreign Born					
Yes	12.5	16.1	17.1	28.7	0.008
No	87.5	83.9	82.9	71.3	
Social Factors					
Lack of Social Support					
Low	10.4	8.0	20.0	24.8	0.001
Moderate/ High	89.6	92.0	80.0	75.2	
Any abuse					
No	59.6	68.6	70.6	85.2	<0.001
Abuse or Fear of Abuse	40.4	31.4	29.4	14.8	
Child Protection involvement					
No	75.0	85.1	80.0	90.0	0.009
Yes (prior or current)	25.0	14.9	20.0	10.0	
Living with father of the baby					
Yes	14.6	23.0	25.7	36.6	0.002
No	85.4	77.0	74.3	63.4	
Behavioral Factors					
Alcohol Use					
Low or No pre-pregnancy use/ No Prenatal Use	54.2	67.8	62.9	76.4	0.003
Any Prenatal or High Pre-pregnancy Use	45.8	32.2	37.1	23.6	
Drug Use					
No	52.1	60.9	64.7	70.8	0.028
Yes (Prenatal or Pre-pregnancy)	47.9	39.1	35.3	29.2	
Cigarette Use					
No Prenatal/ No or < daily Pre-pregnancy	45.8	66.3	61.8	73.3	0.001

Table 4.3. Association of personal, social, behavioral, and environmental factors with elevated depressive symptom levels among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 594)

	Prenatal and Postpartum (n = 48)	Prenatal only (n = 87)	Postpartum only (n = 35)	Low (both periods) (n = 424)	P-value
Any prenatal use or daily pre-pregnancy	54.2	33.7	38.2	26.7	
Environmental Factors					
Lack of Phone Access					
Low	77.1	87.4	77.1	91.0	0.004
Moderate/ High	22.9	12.6	22.9	9.0	
Lack of Transportation Access					
Low	31.3	34.5	31.4	43.9	0.103
Moderate/ High	68.8	65.5	68.6	56.1	
Food Insecurity					
Low	41.7	37.9	58.8	64.9	< 0.001
Moderate/ High	58.3	62.1	41.2	35.1	
Housing Instability					
Low	27.1	25.3	45.7	40.1	0.019
Moderate/ High	72.9	74.7	54.3	59.9	

Table 4.4. Multinomial regression models for prenatal and postpartum, prenatal only, and postpartum only elevated depressive symptom levels compared to low in both periods among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 594)

	Prenatal and Postpartum (n =48)			Prenatal Only (n = 87)			Postpartum Only (n =35)		
	OR	**CI**	**P-value**	**OR**	**CI**	**P-value**	**OR**	**CI**	**P-value**
Personal Characteristics									
Age									
25+	Ref			Ref			Ref		
< 25	.39	(0.19, 0.79)	0.009	0.40	(0.23, 0.70)	0.001	.73	(0.30, 1.79)	0.496
Race/ Ethnicity									
Asian/Pacific Islander	Ref			Ref			Ref		
African American	1.55	(0.30, 7.96)	0.598	1.63	(0.56, 4.70)	0.370	0.35	(0.03, 3.73)	0.390
American Indian	1.68	(0.56, 5.02)	0.351	1.53	(0.68, 3.45)	0.301	2.91	(0.76, 11.06)	0.118
Hispanic, White, or Multiple	1.30	(0.39, 4.38)	0.670	0.69	(0.25, 1.90)	0.469	1.64	(0.36, 7.51)	0.521
Foreign Born									
Yes	Ref			Ref			Ref		
No	1.81	(0.57, 5.77)	0.314	2.36	(1.06, 5.29)	0.036	0.81	(0.27, 2.48)	0.717
Social Factors									
Lack of Social Support									
Low	Ref			Ref			Ref		
Moderate/ High	1.87	(0.68, 5.17)	0.228	2.60	(1.11, 6.06)	0.027	1.22	(0.45, 3.26)	0.697
Any Abuse									
No	Ref			Ref			Ref		
Abuse or Fear of Abuse	2.20	(1.07, 4.55)	0.032	1.75	(0.96, 3.19)	0.069	1.91	(0.80, 4.57)	0.147
Child Protection involvement									
No	Ref			Ref			Ref		
Yes (prior or current)	1.46	(0.61, 3.49)	0.391	1.06	(0.49, 2.29)	0.886	1.55	(0.52, 4.66)	0.434
Living with father of the baby									
Yes	Ref			Ref			Ref		
No	2.76	(1.13, 6.73)	0.026	1.64	(0.89, 3.03)	0.112	1.33	(0.54, 3.27)	0.536

Table 4.4. Multinomial regression models for prenatal and postpartum, prenatal only, and postpartum only elevated depressive symptom levels compared to low in both periods among women receiving care at Twin Cities Healthy Start clinics, 2005-2009 (n = 594)

	Prenatal and Postpartum (n =48)			Prenatal Only (n = 87)			Postpartum Only (n =35)		
	OR	**CI**	**P-value**	**OR**	**CI**	**P-value**	**OR**	**CI**	**P-value**
Behavioral Factors									
Alcohol Use									
Low or No pre-pregnancy use/ No Prenatal Use	Ref			Ref			Ref		
Any Prenatal or High Pre-pregnancy Use	1.56	(0.74, 3.31)	0.247	1.18	(0.64, 2.19)	0.600	1.74	(0.71, 4.24)	0.223
Drug Use									
No	Ref			Ref			Ref		
Yes (Prenatal or Pre-pregnancy)	0.97	(0.46, 2.08)	0.946	1.19	(0.65, 2.18)	0.572	0.61	(0.244, 1.54)	0.299
Cigarette Use									
No Prenatal/ No or < daily Pre-pregnancy	Ref			Ref			Ref		
Any prenatal use or daily pre-pregnancy	2.11	(1.01, 4.43)	0.048	1.01	(0.55, 1.84)	0.975	1.36	(0.56, 3.31)	0.504
Environmental Factors									
Lack of Phone Access									
Low	Ref			Ref			Ref		
Moderate/ High	2.21	(0.89, 5.47)	0.086	1.23	(0.55, 2.76)	0.617	3.91	(1.46, 10.48)	0.007
Food Insecurity									
Low	Ref			Ref			Ref		
Moderate/ High	1.84	(0.93, 3.67)	0.082	2.44	(1.43, 4.16)	0.001	1.14	(0.51, 2.56)	0.749
Housing Instability									
Low	Ref			Ref			Ref		
Moderate/ High	1.25	(0.60, 2.61)	0.553	1.63	(0.91, 2.94)	0.103	0.56	(0.26, 1.23)	0.150

Chapter 5: Conclusions

Findings

This dissertation explored the hypotheses that elevated prenatal depressive symptoms and poor social support are risk factors for late prenatal care entry, less than adequate prenatal care, and poor birth outcomes. Findings were mixed no associations identified for some outcomes (depressive symptoms and late care; depressive symptoms, social support and birth outcomes), a decreased risk identified (depressive symptoms and less than adequate care), and some findings supported the hypotheses (social support and less than adequate care; and partner support combined with depressive symptoms for late care). Additionally, this dissertation found women in the study sample were most likely to experience elevated depressive symptoms in the prenatal period only (15%), followed by both periods (8%), with the postpartum period only having the lowest level (6%). Findings also indicated half of those experiencing depressive symptoms in the postpartum period had elevated symptoms at entry to prenatal care. Women with elevated depressive symptoms at any period were more likely to experience social, behavioral, and environmental risks.

Social support, depressive symptoms and prenatal care

Late prenatal care in the sample (37%) was much higher than the state level (14%) (104), and 29% had less than adequate care. Contrary to the hypotheses, depressive symptoms were not found to be a risk for either late entry or inadequate care. Rather, elevated depressive symptoms were negatively associated with less than adequate prenatal care. In

adjusted analyses, women with moderate/high depressive scores were less likely than women with low scores (AOR 0.73, p = 0.022) to receive less than adequate care. While contrary to our original hypothesis, this finding is consistent with studies that indicate that adults with depression are more likely to receive general health care (105-107) than non-depressed individuals. Since early care is one component of adequacy, our finding may also be consistent with a study of medical records for over 90,000 women that found women with clinical depression were more likely to get early care (45).

The hypothesis of poor support associated with prenatal care was supported: low overall social support was related to less than adequate prenatal care and partner support was associated with late care. Women with moderate/poor social support were more likely (AOR 1.29, p = 0.018) to get less than adequate care compared to women with good support. One of the innovative features of this dissertation was the inclusion of both depressive symptoms and social support, enabling the examination of interactions. No other study was located that examined both of these measures in relation to prenatal care. An interaction was identified indicating women with moderate/high depressive symptoms and no/low partner support were at the highest odds of late prenatal care (AOR 1.85) compared to women with low depressive symptoms and good partner support. The next highest risk of late care among women with no/low support and low depressive system (AOR 1.27) while those with moderate/high depressive symptoms and good partner support have decreased odds of late care (AOR 0.74) compared to those with good support and low depression. While the interaction with depression is a new finding, our

results align with other findings on association with father involvement and the start of prenatal care (108, 109).

Social support, depressive symptoms and birth outcomes

Findings did not support the hypotheses of elevated depressive symptoms and low social support as risk factors for poor birth outcomes. While we found some associations of depressive symptoms and social support measures with LBW and SGA in unadjusted analyses, they disappeared when we adjusted for the many other demographic, social, and environmental variables in the study. Our findings indicate depressive symptoms and social support were not independent risk factors for PTB, LBW, or SGA in our socially vulnerable sample. Additionally, we did not find any interactions for social support and depressive symptoms with regard to birth outcomes. Null findings for depressive symptoms and birth outcomes are not uncommon with more than half of the US prospective studies we reviewed finding no association. A comparison of our study with other prospective US studies did not identify any specific methodological differences that potentially account for our (and other studies) null findings compared to others. The exclusion of some risk factors (pre-pregnancy BMI or prior poor outcomes) is a limitation of our design but did not seem to be a distinguishing factor in studies that did and did not identify depression as a risk. Additionally, while prior studies of social support and birth outcomes were mixed, they were also limited by study design factors that were generally addressed in the current study.

Prenatal and postpartum depressive symptoms

A higher proportion of women in this study sample experienced elevated depressive symptom levels in pregnancy (23%) compared to in the postpartum period (14%). The proportion of women with elevated depressive symptoms in this sample during the prenatal period is higher than those reported in general populations (7-12%) (15) while the proportion in the postpartum period may be within the range of those found in a general population (6-19%) (36, 197). Based on the combination of prenatal and postpartum PHQ-9 scores, 71.4 % had low depressive symptom levels at both time points. Elevated levels were seen for 14.6% during the prenatal period only, 8.1% during both periods, and 5.9% during the postpartum period only. Thirty-six percent of those with elevated symptom levels prenatally also had elevated levels postpartum. Of the women with elevated depressive symptom levels in the postpartum period, 58% also had elevated levels in the prenatal period.

With the exception of transportation access, all of the social, behavioral, and environmental risk correlates and personal characteristics examined were significantly higher for women experiencing elevated depressive symptom levels at any time compared to those with low symptoms during both time periods. Additionally, levels of risk factors were generally highest among those with elevated depressive symptoms during both periods. In adjusted models, we found different risk factors were associated with increased risk of experiencing elevated depressive symptoms in either the prenatal only, prenatal and postpartum, or postpartum only periods. Experiencing abuse, not living with the father of the infant and smoking were all associated with increased odds of being in the group with elevated depressive symptom levels during both pregnancy and

postpartum. The odds of experiencing elevated depressive symptom levels in the prenatal period only compared to the low symptom group were increased for women who were US born, lacked social support, and were experiencing prenatal food insecurity. Only one risk factor, lack of phone access, remained significantly associated with increased risk of experiencing elevated depressive symptom levels in the postpartum period only compared to the low symptom group.

Additional Findings

The papers in this dissertation contribute additional findings beyond the hypothesis tested. Specifically, the unique set of covariates allowed the documentation of life circumstances experienced by women who received care at community health centers. Each paper characterized these myriad risk factors and social needs of this group of women. For example, in the second paper which has the largest sample size, only 29% of women had good overall social support, 21% reported no/low partner support. Over half (57%) were single and not living with the father of the baby. Measures of abuse indicate 14% were either experiencing abuse or in a situation where they feared abuse. Environmental risk factors were also high with 50% reporting unstable housing, 47% with transportation problems, one third (33%) reporting some level of food insecurity and 10% reporting limited phone access. Many women (44%) were experiencing 2-4 of these environmental risks at the same time. Several of the risk factors documented in this study sample are not typically examined in studies of prenatal care, birth outcomes, or risk of depression. Several of the environmental measures (i.e., transportation, food insecurity, housing stability) as well as the number of these risks a woman was experiencing were

associated with study outcomes to some degree (birth outcomes prior to adjustment and depressive symptoms after adjustment).

Public health implications

The findings from this dissertation may have implications for clinical settings and public health programs that provide care, guide policy or develop enhanced care programs for low-income women. The work of this dissertation is connected to several public health goals. Specifically Healthy People 2020 includes objectives focused on increasing the prevalence of women getting early prenatal care, increasing the prevalence of women getting adequate prenatal care, reducing the prevalence of low birthweight and preterm births, and a reducing the prevalence of women affected by postpartum depression (1).

With regard to improving prenatal care attendance, our findings indicate poor social support at entry into prenatal care increased risk of getting less than adequate care. This association could be reflective of the lack of several components of social support – educational support related to prenatal care, instrumental support specific to logistics of getting care or addressing barriers to care, emotional support related to the pregnancy. Our measure did not provide sufficient detail to determine what aspects of social support may be most closely linked to prenatal care adequacy. A better understanding of specific support components might identify opportunities for intervention to help address barriers to regular prenatal care attendance. Findings from the current study indicate screening for social support may be useful to identify women at risk for poor prenatal care attendance. Depending on what aspects of social support are impacting prenatal care attendance, this

factor may or may not be intervenable. Women with low social support may benefit from initiatives to improve social support throughout prenatal care. Several models of prenatal care, or enhanced prenatal care such as doulas, group prenatal care (112, 113), and home visiting (114) may be potential sources of social support in general or provide support to address barriers to care. Further research is needed to determine if these programs are associated with improved prenatal care attendance and if social support may play a role.

Our finding that women with elevated depressive symptoms and no/low partner support were at increased risk of receiving late care is challenging to link to actionable implications for a clinical setting. Women with no/low partner support may have faced challenges addressing the pregnancy with a partner prior to starting prenatal care. Additionally, for women with depressive symptoms, a partner may have been key for addressing logistical challenges with getting into care, particularly in the context of depressive symptoms. These findings support public health recommendations to improve regular depression screening for adults which may help reduce women entering pregnancy with depressive symptoms. However, given the limited contact clinics have with women and their partners in a preconception context or during the time between pregnancy identification and prenatal care start, identifying opportunities within the clinical setting for intervention with regard to the role of partner support is challenging.

With regard to public health goals of reducing poor birth outcomes, the findings of this study indicate that depressive symptoms and social support measures may not the most

important predictors to examine when focusing on identifying risk factors for poor birth outcomes in socially vulnerable, low-income, racially diverse urban populations.

With regard to the Healthy People 2020 goal of reducing the prevalence of women affected by postpartum depression, one of the key lessons from our study, is that screening prenatally for depressive symptoms could potentially identify over half of the women who are at risk for elevated postpartum depressive symptoms. Prior to 2015, ACOG recommendations for depression screening in pregnancy or postpartum were relatively vague indicating that providers should consider depression screening during or after pregnancy. They indicated a lack of evidence to support a firm recommendation for universal prenatal or postpartum screening or to recommend how often screening should be done (43). In May 2015, ACOG revised their recommendations (33) to indicate that clinicians should screen patients at least once during the perinatal period and to closely monitor those with current or history of depression or other mood disorders. The ACOG Committee Opinion does not make a recommendation for providers to prioritize screening in either the prenatal or postpartum period or reference how depressive symptoms in either period are associated. In January 2016, the US Preventive Services Task Force issued a recommendation statement regarding screening for depression in the adult population (34). Included in this statement is the recommendation for depression screening during both the prenatal and postpartum periods.

Our study findings of higher prevalence in the prenatal period and the strong association between prenatal and postpartum depressive symptoms support these recommendations.

While screening is not sufficient for reducing depression, it is a key first step toward identifying women who need further treatment and linking them to the most appropriate type of treatment. The new guidelines identify evidence that cognitive behavioral therapy improves clinical outcomes in pregnant and postpartum women with depression (34). In addition to findings about prevalence of depressive symptoms during the prenatal and postpartum periods, our study demonstrated higher depressive symptom levels than found in general populations indicating that screening and related interventions may be more needed in populations similar to those of this study.

Additionally, in this study's low income population, there were unique personal, behavioral, and environmental risk factors associated with experiencing depressive symptoms at different time periods. Screening for such a comprehensive set of personal, behavioral, and environmental risk factors may identify women at increased risk of depressive symptoms during pregnancy and/or the postpartum period as well as document some of the barriers and challenges they are facing along with depressive symptoms. While additional work may be needed to identify the most appropriate treatment programs to address elevated depressive symptoms in high risk populations such as those in this study sample, incorporating standards for increased screening and treatment are supported by the findings of this dissertation.

Future Research

Findings of this study indicated that poor overall social support was associated with increased risk of receiving less than adequate care. Our measure did not provide

sufficient detail to determine what aspects of social support may be most closely linked to prenatal care adequacy – emotional, instrumental, or educational. Future research exploring social support and prenatal care attendance would benefit from more detailed measures to determine which aspects of social support are related to prenatal care and the level to which those factors are intervenable.

Partner support was associated with late care when combined with depressive symptoms. In our study 57% of women were not married or living with the father of the baby and 21% reported no/low partner support. In our study, a general measure of friend support was not independently associated with any outcomes. Future research on support mechanisms in samples similar to this one, with high proportions of single women with limited partner involvement may need to explore other sources of support in more detail as well as identifying key components within partner support understanding where women may turn for logistical help addressing barriers to care, advice about care, emotional support for their pregnancy.

This dissertation included a set of comprehensive risk factors relevant to the lives of low-income women. Several of these individual risks, as well as the sum of simultaneous risks, were associated with birth outcomes in unadjusted models and were identified as independently associated with experiencing either depressive symptoms in either the prenatal, postpartum, or during both periods. These measures have the potential to impact health and well-being of pregnant and postpartum women and several had relatively high

prevalence levels in this study sample. These risks may warrant further exploration in studies of perinatal health outcomes. The association of these risks with depression may be important in future research exploring what types of depression treatment work best in low-income populations.

References

1. Healthy People 2020: U.S. Department of Health and Human Services. Office of Disease Prevention and Health Promotion
[October 18, 2014]. Available from: http://www.healthypeople.gov/2020/topicsobjectives2020/default.aspx.
2. Goldenberg RL, Culhane JF. Low birth weight in the United States. The American journal of clinical nutrition. 2007 Feb;85(2):584S-90S. PubMed PMID: 17284760. Epub 2007/02/08. eng.
3. Damus K. Prevention of preterm birth: a renewed national priority. Curr Opin Obstet Gynecol. 2008 Dec;20(6):590-6. PubMed PMID: 18989136. Epub 2008/11/08. eng.
4. Child Health USA 2013. Rockfille, Maryland: U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2013.
5. Saenger P, Czernichow P, Hughes I, Reiter EO. Small for gestational age: short stature and beyond. Endocr Rev. 2007 Apr;28(2):219-51. PubMed PMID: 17322454. Epub 2007/02/27. eng.
6. Martin JA, Hamilton BE, Osterman MJ, Curtin SC, Matthews TJ. Births: final data for 2013. National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2015 Jan;64(1):1-68. PubMed PMID: 25603115.
7. Creanga AA, Berg CJ, Syverson C, Seed K, Bruce FC, Callaghan WM. Pregnancy-related mortality in the United States, 2006-2010. Obstetrics and gynecology. 2015 Jan;125(1):5-12. PubMed PMID: 25560097.
8. Mathews TJ, MacDorman MF. Infant mortality statistics from the 2009 period linked birth/infant death data set. National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2013 Jan 24;61(8):1-27. PubMed PMID: 24979974.
9. Beck LF, Morrow B, Lipscomb LE, Johnson CH, Gaffield ME, Rogers M, et al. Prevalence of selected maternal behaviors and experiences, Pregnancy Risk Assessment Monitoring System (PRAMS), 1999. Morbidity and mortality weekly report Surveillance summaries. 2002 Apr 26;51(2):1-27. PubMed PMID: 12004983.
10. Hobfoll SE, Ritter C, Lavin J, Hulsizer MR, Cameron RP. Depression prevalence and incidence among inner-city pregnant and postpartum women. Journal of consulting and clinical psychology. 1995 Jun;63(3):445-53. PubMed PMID: 7608357. Epub 1995/06/01. eng.
11. Phares TM, Morrow B, Lansky A, Barfield WD, Prince CB, Marchi KS, et al. Surveillance for disparities in maternal health-related behaviors--selected states, Pregnancy Risk Assessment Monitoring System (PRAMS), 2000-2001. Morbidity and mortality weekly report Surveillance summaries. 2004 Jul 2;53(4):1-13. PubMed PMID: 15229409.

12. El-Sayed AM, Finkton DW, Jr., Paczkowski M, Keyes KM, Galea S. Socioeconomic position, health behaviors, and racial disparities in cause-specific infant mortality in Michigan, USA. Preventive medicine. 2015 Jul;76:8-13. PubMed PMID: 25849882. Pubmed Central PMCID: 4671200.
13. Little M, Shah R, Vermeulen MJ, Gorman A, Dzendoletas D, Ray JG. Adverse perinatal outcomes associated with homelessness and substance use in pregnancy. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2005 Sep 13;173(6):615-8. PubMed PMID: 16157725. Pubmed Central PMCID: 1197161.
14. Stein JA, Lu MC, Gelberg L. Severity of homelessness and adverse birth outcomes. Health psychology : official journal of the Division of Health Psychology, American Psychological Association. 2000 Nov;19(6):524-34. PubMed PMID: 11129355.
15. Bennett HA, Einarson A, Taddio A, Koren G, Einarson TR. Prevalence of depression during pregnancy: systematic review. Obstetrics and gynecology. 2004 Apr;103(4):698-709. PubMed PMID: 15051562. Epub 2004/03/31. eng.
16. Kim HG, Mandell M, Crandall C, Kuskowski MA, Dieperink B, Buchberger RL. Antenatal psychiatric illness and adequacy of prenatal care in an ethnically diverse inner-city obstetric population. Arch Womens Ment Health. 2006 Mar;9(2):103-7. PubMed PMID: 16380813.
17. Alexander GR, Kotelchuck M. Assessing the role and effectiveness of prenatal care: history, challenges, and directions for future research. Public health reports. 2001 Jul-Aug;116(4):306-16. PubMed PMID: 12037259. Pubmed Central PMCID: 1497343.
18. Reichman NE, Teitler JO. Effects of psychosocial risk factors and prenatal interventions on birth weight: evidence from New Jersey's HealthStart program. Perspectives on sexual and reproductive health. 2003 May-Jun;35(3):130-7. PubMed PMID: 12866786.
19. Herbst MA, Mercer BM, Beazley D, Meyer N, Carr T. Relationship of prenatal care and perinatal morbidity in low-birth-weight infants. American journal of obstetrics and gynecology. 2003 Oct;189(4):930-3. PubMed PMID: 14586328.
20. Vintzileos AM, Ananth CV, Smulian JC, Scorza WE, Knuppel RA. The impact of prenatal care in the United States on preterm births in the presence and absence of antenatal high-risk conditions. American journal of obstetrics and gynecology. 2002 Nov;187(5):1254-7. PubMed PMID: 12439515.
21. Krueger PM, Scholl TO. Adequacy of prenatal care and pregnancy outcome. The Journal of the American Osteopathic Association. 2000 Aug;100(8):485-92. PubMed PMID: 10979253.
22. Wulf KH, Steck T. The impact of timing and frequency of prenatal visits on the outcome of pregnancy in the perinatal registry of Bavaria 1987-1988. European journal of obstetrics, gynecology, and reproductive biology. 1994 Nov;57(2):79-84. PubMed PMID: 7859909.
23. Poma PA. Effect of prenatal care on infant mortality rates according to birth-death certificate files. Journal of the National Medical Association. 1999 Sep;91(9):515-20. PubMed PMID: 10517072. Pubmed Central PMCID: 2608536.
24. Partridge S, Balayla J, Holcroft CA, Abenhaim HA. Inadequate prenatal care utilization and risks of infant mortality and poor birth outcome: a retrospective analysis

of 28,729,765 U.S. deliveries over 8 years. American journal of perinatology. 2012 Nov;29(10):787-93. PubMed PMID: 22836820.
25. Kotelchuck M. The Adequacy of Prenatal Care Utilization Index: its US distribution and association with low birthweight. American journal of public health. 1994 Sep;84(9):1486-9. PubMed PMID: 8092377. Pubmed Central PMCID: 1615176. Epub 1994/09/01. eng.
26. Tayebi T, Zahrani ST, Mohammadpour R. Relationship between adequacy of prenatal care utilization index and pregnancy outcomes. Iranian journal of nursing and midwifery research. 2013 Sep;18(5):360-6. PubMed PMID: 24403937. Pubmed Central PMCID: 3877457.
27. Zolotor AJ, Carlough MC. Update on prenatal care. American family physician. 2014 Feb 1;89(3):199-208. PubMed PMID: 24506122.
28. Feijen-de Jong EI, Jansen DE, Baarveld F, van der Schans CP, Schellevis FG, Reijneveld SA. Determinants of late and/or inadequate use of prenatal healthcare in high-income countries: a systematic review. European journal of public health. 2012 Dec;22(6):904-13. PubMed PMID: 22109988.
29. Curtin SC, Osterman MJ, Uddin SF, Sutton SR, Reed PR. Source of payment for the delivery: births in a 33-state and District of Columbia reporting area, 2010. National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2013 Dec 19;62(5):1-20. PubMed PMID: 24364892.
30. Lusskin SI, Pundiak TM, Habib SM. Perinatal depression: hiding in plain sight. Can J Psychiatry. 2007 Aug;52(8):479-88. PubMed PMID: 17955909. Epub 2007/10/25. eng.
31. O'Hara MW. Postpartum depression: what we know. Journal of clinical psychology. 2009 Dec;65(12):1258-69. PubMed PMID: 19827112. Epub 2009/10/15. eng.
32. Marcus SM, Flynn HA, Blow FC, Barry KL. Depressive symptoms among pregnant women screened in obstetrics settings. J Womens Health (Larchmt). 2003 May;12(4):373-80. PubMed PMID: 12804344. Epub 2003/06/14. eng.
33. Committee on Obstetric P. The American College of Obstetricians and Gynecologists Committee Opinion no. 630. Screening for perinatal depression. Obstetrics and gynecology. 2015 May;125(5):1268-71. PubMed PMID: 25932866.
34. Siu AL, Force USPST, Bibbins-Domingo K, Grossman DC, Baumann LC, Davidson KW, et al. Screening for Depression in Adults: US Preventive Services Task Force Recommendation Statement. Jama. 2016 Jan 26;315(4):380-7. PubMed PMID: 26813211.
35. Szegda K, Markenson G, Bertone-Johnson ER, Chasan-Taber L. Depression during pregnancy: a risk factor for adverse neonatal outcomes? A critical review of the literature. The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet. 2014 Jun;27(9):960-7. PubMed PMID: 24044422.
36. Gaynes BN, Gavin N, Meltzer-Brody S, Lohr KN, Swinson T, Gartlehner G, et al. Perinatal depression: prevalence, screening accuracy, and screening outcomes. Evid Rep

Technol Assess (Summ). 2005 Feb(119):1-8. PubMed PMID: 15760246. Epub 2005/03/12. eng.
37. Goyal D, Gay C, Lee KA. How much does low socioeconomic status increase the risk of prenatal and postpartum depressive symptoms in first-time mothers? Women's health issues : official publication of the Jacobs Institute of Women's Health. 2010 Mar-Apr;20(2):96-104. PubMed PMID: 20133153. Pubmed Central PMCID: 2835803.
38. Orr ST, Blazer DG, James SA. Racial disparities in elevated prenatal depressive symptoms among black and white women in eastern north Carolina. Annals of epidemiology. 2006 Jun;16(6):463-8. PubMed PMID: 16257228.
39. Melville JL, Gavin A, Guo Y, Fan MY, Katon WJ. Depressive disorders during pregnancy: prevalence and risk factors in a large urban sample. Obstetrics and gynecology. 2010 Nov;116(5):1064-70. PubMed PMID: 20966690. Pubmed Central PMCID: 3068619. Epub 2010/10/23. eng.
40. J.S. H. Work Stress and Social Support. Reading, MA.: Addison-Wesley Educational Publishers Inc; 1981.
41. C.A. H, B.A. I. Social Networks and Social Support. In: K. G, B.K. R, F.M. L, editors. Health Behavior and Health Education 3rd ed. San Francisco: Jossey-Bass Publishers; 2002. p. 165-84.
42. Berkman LF, Glass T. Social Integration, Social Networks, Social Support and Health. In: Berkman LF, Kawachi I, editors. Social Epidemiology. New York: Oxford University Press; 2000. p. 137-73.
43. Committee opinion no. 453: Screening for depression during and after pregnancy. Obstetrics and gynecology. 2010 Feb;115(2 Pt 1):394-5. PubMed PMID: 20093921. Epub 2010/01/23. eng.
44. Johnson AA, El-Khorazaty MN, Hatcher BJ, Wingrove BK, Milligan R, Harris C, et al. Determinants of late prenatal care initiation by African American women in Washington, DC. Maternal and child health journal. 2003 Jun;7(2):103-14. PubMed PMID: 12870626.
45. Pagnini DL, Reichman NE. Psychosocial factors and the timing of prenatal care among women in New Jersey's HealthStart program. Family planning perspectives. 2000 Mar-Apr;32(2):56-64. PubMed PMID: 10779236.
46. Heaman MI, Moffatt M, Elliott L, Sword W, Helewa ME, Morris H, et al. Barriers, motivators and facilitators related to prenatal care utilization among inner-city women in Winnipeg, Canada: a case-control study. BMC pregnancy and childbirth. 2014;14:227. PubMed PMID: 25023478. Pubmed Central PMCID: 4223395.
47. Luecken LJ, Purdom CL, Howe R. Prenatal care initiation in Low-income Hispanic women: risk and protective factors. American journal of health behavior. 2009 May-Jun;33(3):264-75. PubMed PMID: 19063648.
48. Webster J, Linnane JW, Dibley LM, Hinson JK, Starrenburg SE, Roberts JA. Measuring social support in pregnancy: can it be simple and meaningful? Birth. 2000 Jun;27(2):97-101. PubMed PMID: 11251486.
49. Schaffer MA, Lia-Hoagberg B. Effects of social support on prenatal care and health behaviors of low-income women. Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG. 1997 Jul-Aug;26(4):433-40. PubMed PMID: 9252891.

50. Sable MR, Stockbauer JW, Schramm WF, Land GH. Differentiating the barriers to adequate prenatal care in Missouri, 1987-88. Public health reports. 1990 Nov-Dec;105(6):549-55. PubMed PMID: 2124354. Pubmed Central PMCID: 1580177.
51. Higgins P, Murray ML, Williams EM. Self-esteem, social support, and satisfaction differences in women with adequate and inadequate prenatal care. Birth. 1994 Mar;21(1):26-33. PubMed PMID: 8155221.
52. Almeida J, Mulready-Ward C, Bettegowda VR, Ahluwalia IB. Racial/Ethnic and nativity differences in birth outcomes among mothers in New York City: the role of social ties and social support. Maternal and child health journal. 2014 Jan;18(1):90-100. PubMed PMID: 23435918.
53. Feldman PJ, Dunkel-Schetter C, Sandman CA, Wadhwa PD. Maternal social support predicts birth weight and fetal growth in human pregnancy. Psychosomatic medicine. 2000 Sep-Oct;62(5):715-25. PubMed PMID: 11020102.
54. Collins NL, Dunkel-Schetter C, Lobel M, Scrimshaw SC. Social support in pregnancy: psychosocial correlates of birth outcomes and postpartum depression. Journal of personality and social psychology. 1993 Dec;65(6):1243-58. PubMed PMID: 8295121.
55. Elsenbruch S, Benson S, Rucke M, Rose M, Dudenhausen J, Pincus-Knackstedt MK, et al. Social support during pregnancy: effects on maternal depressive symptoms, smoking and pregnancy outcome. Human reproduction. 2007 Mar;22(3):869-77. PubMed PMID: 17110400.
56. Wado YD, Afework MF, Hindin MJ. Effects of maternal pregnancy intention, depressive symptoms and social support on risk of low birth weight: a prospective study from southwestern Ethiopia. PloS one. 2014;9(5):e96304. PubMed PMID: 24848269. Pubmed Central PMCID: 4029816.
57. Zhao Y, Kershaw T, Ettinger AS, Higgins C, Lu MC, Chao SM. Association Between Life Event Stressors and Low Birth Weight in African American and White Populations: Findings from the 2007 and 2010 Los Angeles Mommy and Baby (LAMB) Surveys. Maternal and child health journal. 2015 Feb 11. PubMed PMID: 25665895.
58. Orr ST. Social support and pregnancy outcome: a review of the literature. Clinical obstetrics and gynecology. 2004 Dec;47(4):842-55; discussion 81-2. PubMed PMID: 15596938.
59. Dunkel Schetter C. Psychological science on pregnancy: stress processes, biopsychosocial models, and emerging research issues. Annual review of psychology. 2011;62:531-58. PubMed PMID: 21126184.
60. Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A meta-analysis of depression during pregnancy and the risk of preterm birth, low birth weight, and intrauterine growth restriction. Archives of general psychiatry. 2010 Oct;67(10):1012-24. PubMed PMID: 20921117. Pubmed Central PMCID: 3025772. Epub 2010/10/06. eng.
61. Accortt EE, Cheadle AC, Dunkel Schetter C. Prenatal Depression and Adverse Birth Outcomes: An Updated Systematic Review. Maternal and child health journal. 2014 Dec 2. PubMed PMID: 25452215.
62. Wisner KL, Parry BL, Piontek CM. Clinical practice. Postpartum depression. N Engl J Med. 2002 Jul 18;347(3):194-9. PubMed PMID: 12124409. Epub 2002/07/19. eng.

63. Miller LJ. Postpartum depression. Jama. 2002 Feb 13;287(6):762-5. PubMed PMID: 11851544. Epub 2002/02/20. eng.
64. Evans J, Heron J, Francomb H, Oke S, Golding J. Cohort study of depressed mood during pregnancy and after childbirth. BMJ. 2001 Aug 4;323(7307):257-60. PubMed PMID: 11485953. Pubmed Central PMCID: 35345. Epub 2001/08/04. eng.
65. Felice E, Saliba J, Grech V, Cox J. Prevalence rates and psychosocial characteristics associated with depression in pregnancy and postpartum in Maltese women. Journal of affective disorders. 2004 Oct 15;82(2):297-301. PubMed PMID: 15488261. Epub 2004/10/19. eng.
66. Andersson L, Sundstrom-Poromaa I, Wulff M, Astrom M, Bixo M. Depression and anxiety during pregnancy and six months postpartum: a follow-up study. Acta obstetricia et gynecologica Scandinavica. 2006;85(8):937-44. PubMed PMID: 16862471. Epub 2006/07/25. eng.
67. Rich-Edwards JW, Kleinman K, Abrams A, Harlow BL, McLaughlin TJ, Joffe H, et al. Sociodemographic predictors of antenatal and postpartum depressive symptoms among women in a medical group practice. Journal of epidemiology and community health. 2006 Mar;60(3):221-7. PubMed PMID: 16476752. Pubmed Central PMCID: 2465548. Epub 2006/02/16. eng.
68. Heron J, O'Connor TG, Evans J, Golding J, Glover V. The course of anxiety and depression through pregnancy and the postpartum in a community sample. Journal of affective disorders. 2004 May;80(1):65-73. PubMed PMID: 15094259. Epub 2004/04/20. eng.
69. Gotlib IH, Whiffen VE, Mount JH, Milne K, Cordy NI. Prevalence rates and demographic characteristics associated with depression in pregnancy and the postpartum. Journal of consulting and clinical psychology. 1989 Apr;57(2):269-74. PubMed PMID: 2785127. Epub 1989/04/01. eng.
70. Gotlib IH, Whiffen VE, Wallace PM, Mount JH. Prospective investigation of postpartum depression: factors involved in onset and recovery. Journal of abnormal psychology. 1991 May;100(2):122-32. PubMed PMID: 2040762. Epub 1991/05/01. eng.
71. Silva R, Jansen K, Souza L, Quevedo L, Barbosa L, Moraes I, et al. Sociodemographic risk factors of perinatal depression: a cohort study in the public health care system. Rev Bras Psiquiatr. 2012 Jun;34(2):143-8. PubMed PMID: 22729409. Epub 2012/06/26. eng.
72. Sexton MB, Flynn HA, Lancaster C, Marcus SM, McDonough SC, Volling BL, et al. Predictors of recovery from prenatal depressive symptoms from pregnancy through postpartum. J Womens Health (Larchmt). 2012 Jan;21(1):43-9. PubMed PMID: 22060255. Pubmed Central PMCID: 3256560. Epub 2011/11/09. eng.
73. Flay BR. Understanding environmental, situational and intrapersonal risk and protective factors for youth tobacco use: the Theory of Triadic Influence. Nicotine Tob Res. 1999;1 Suppl 2:S111-4; discussion 569-70. PubMed PMID: 11768166. Epub 2002/01/05. eng.
74. Gyllstrom ME, Jensen JL, Vaughan JN, Castellano SE, Oswald JW. Linking birth certificates with Medicaid data to enhance population health assessment: methodological issues addressed. Journal of public health management and practice : JPHMP. 2002 Jul;8(4):38-44. PubMed PMID: 15156637.

75. American Academy of Pediatrics, American College of Obstetricians and Gynecologists. Guidelines for Perinatal Care. 7th ed. Elk Grove Village, IL: AAP; Washington, DC: AGOC: American Academy of Pediatrics and American College of Obstetricians and Gynecologists; 2012.
76. El-Mohandes A, Herman AA, Nabil El-Khorazaty M, Katta PS, White D, Grylack L. Prenatal care reduces the impact of illicit drug use on perinatal outcomes. Journal of perinatology : official journal of the California Perinatal Association. 2003 Jul-Aug;23(5):354-60. PubMed PMID: 12847528.
77. Martin JA, Hamilton BE, Sutton PD, Ventura SJ, Menacker F, Munson ML. Births: final data for 2003. National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2005 Sep 8;54(2):1-116. PubMed PMID: 16176060.
78. Osterman MJ, Martin JA, Mathews TJ, Hamilton BE. Expanded data from the new birth certificate, 2008. National vital statistics reports : from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. 2011 Jul 27;59(7):1-28. PubMed PMID: 21848043.
79. Dietz PM, Gazmararian JA, Goodwin MM, Bruce FC, Johnson CH, Rochat RW. Delayed entry into prenatal care: effect of physical violence. Obstetrics and gynecology. 1997 Aug;90(2):221-4. PubMed PMID: 9241297.
80. Centers for disease Control. Entry Into Prenatal Care -- United States, 1989 - 1997. MMWR. 2000;49(18):393-8.
81. Ayoola AB, Nettleman MD, Stommel M, Canady RB. Time of pregnancy recognition and prenatal care use: a population-based study in the United States. Birth. 2010 Mar;37(1):37-43. PubMed PMID: 20402720.
82. Orr ST, James SA, Blackmore Prince C. Maternal prenatal depressive symptoms and spontaneous preterm births among African-American women in Baltimore, Maryland. American journal of epidemiology. 2002 Nov 1;156(9):797-802. PubMed PMID: 12396996. Epub 2002/10/25. eng.
83. Dayan J, Creveuil C, Marks MN, Conroy S, Herlicoviez M, Dreyfus M, et al. Prenatal depression, prenatal anxiety, and spontaneous preterm birth: a prospective cohort study among women with early and regular care. Psychosomatic medicine. 2006 Nov-Dec;68(6):938-46. PubMed PMID: 17079701.
84. Engelstad HJ, Roghair RD, Calarge CA, Colaizy TT, Stuart S, Haskell SE. Perinatal outcomes of pregnancies complicated by maternal depression with or without selective serotonin reuptake inhibitor therapy. Neonatology. 2014;105(2):149-54. PubMed PMID: 24356332. Pubmed Central PMCID: 4054700.
85. Kim DR, Sockol LE, Sammel MD, Kelly C, Moseley M, Epperson CN. Elevated risk of adverse obstetric outcomes in pregnant women with depression. Arch Womens Ment Health. 2013 Dec;16(6):475-82. PubMed PMID: 23934018. Pubmed Central PMCID: 3834010.
86. Nylen KJ, O'Hara MW, Engeldinger J. Perceived social support interacts with prenatal depression to predict birth outcomes. Journal of behavioral medicine. 2013 Aug;36(4):427-40. PubMed PMID: 22710981.
87. Minnesota Department of Health, Minnesota Center for Health Statistics, Community and Familiy Division Maternal and Child Health Section. Disparities in Infant Mortality. St. Paul, Minnesota: Minnesota Department of Health 2009.

88. Harrison PA, Sidebottom AC. Systematic prenatal screening for psychosocial risks. Journal of health care for the poor and underserved. 2008 Feb;19(1):258-76. PubMed PMID: 18264001. Epub 2008/02/12. eng.
89. Harrison PA, Godecker A, Sidebottom AC. Validation of the Alcohol Use Module from a Multidimensional Prenatal Psychosocial Risk Screening Instrument. Maternal and child health journal. 2011 Nov 26. PubMed PMID: 22120427. Epub 2011/11/29. Eng.
90. Harrison PA GA, Sidebottom A. Validity of the Prenatal Risk Overview for Detecting Drug Use Disorders in Pregnancy. Public Health Nursing. 2012. Epub July 2012.
91. Sidebottom AC HP, Godecker A, Kim H. Validation of the Patient Health Questionnaire (PHQ-9) for prenatal derpession screening. Archives of Women's Mental Health. 2012;15(5):367-74.
92. Kotelchuck M. An evaluation of the Kessner Adequacy of Prenatal Care Index and a proposed Adequacy of Prenatal Care Utilization Index. American journal of public health. 1994 Sep;84(9):1414-20. PubMed PMID: 8092364. Pubmed Central PMCID: 1615177. Epub 1994/09/01. eng.
93. Spitzer RL, Kroenke K, Williams JB. Validation and utility of a self-report version of PRIME-MD: the PHQ primary care study. Primary Care Evaluation of Mental Disorders. Patient Health Questionnaire. Jama. 1999 Nov 10;282(18):1737-44. PubMed PMID: 10568646. Epub 1999/11/24. eng.
94. Wittkampf KA, Naeije L, Schene AH, Huyser J, van Weert HC. Diagnostic accuracy of the mood module of the Patient Health Questionnaire: a systematic review. General hospital psychiatry. 2007 Sep-Oct;29(5):388-95. PubMed PMID: 17888804. Epub 2007/09/25. eng.
95. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001 Sep;16(9):606-13. PubMed PMID: 11556941. Pubmed Central PMCID: 1495268. Epub 2001/09/15. eng.
96. Kroenke K, Spitzer RL. The PHQ-9: A New Depression Diagnostic and Severity Measure. Psyciatric Annals. 2002 September 2002;32(9):1-7.
97. Pascoe JM, Ialongo NS, Horn WF, Reinhart MA, Perradatto D. The reliability and validity of the maternal social support index. Family medicine. 1988 Jul-Aug;20(4):271-6. PubMed PMID: 3203834. Epub 1988/07/01. eng.
98. Institute. RT. National Survey on Drug Use and Health. CAI Specs for Programming, 2004. English Version. Rockville, MD: Substance Abuse and Mental Health Services Administration: 2003 2003 Dec. Report No.
99. Cherpitel CJ. A brief screening instrument for problem drinking in the emergency room: the RAPS4. Rapid Alcohol Problems Screen. J Stud Alcohol. 2000 May;61(3):447-9. PubMed PMID: 10807217. Epub 2000/05/12. eng.
100. Soeken KL Mj, Parker B, et al. Screening for abuse during pregnancy: impelmenting a multisite program. In: JC C, editor. Empowering survivors of abuse: health care for battered women and their children. Newbury Park, CA: Sage; 1998.
101. Rabin RF, Jennings JM, Campbell JC, Bair-Merritt MH. Intimate partner violence screening tools: a systematic review. American journal of preventive medicine. 2009 May;36(5):439-45 e4. PubMed PMID: 19362697. Pubmed Central PMCID: 2688958.

102. North CS, Eyrich KM, Pollio DE, Foster DA, Cottler LB, Spitznagel EL. The Homeless Supplement to the Diagnostic Interview Schedule: test-retest analyses. Int J Methods Psychiatr Res. 2004;13(3):184-91. PubMed PMID: 15297902. Epub 2004/08/07. eng.
103. Nord M AM, Carlson S. Household food security in the United States, 2002. Appendix A: Household responses to questions in the food security scale. Washington, DC: USDA Economic Research Service, 2003.
104. Minnesota Department of Health Center for Health Statitistics - Vital Statistics Interactive Queries 2014 [12/12/2014]. Available from: https://pqc.health.state.mn.us/mhsq/birth/applicationController.jsp.
105. Egede LE, Ellis C. Diabetes and depression: global perspectives. Diabetes research and clinical practice. 2010 Mar;87(3):302-12. PubMed PMID: 20181405.
106. Egede LE, Zheng D, Simpson K. Comorbid depression is associated with increased health care use and expenditures in individuals with diabetes. Diabetes care. 2002 Mar;25(3):464-70. PubMed PMID: 11874931.
107. Luppa M, Sikorski C, Motzek T, Konnopka A, Konig HH, Riedel-Heller SG. Health service utilization and costs of depressive symptoms in late life - a systematic review. Current pharmaceutical design. 2012;18(36):5936-57. PubMed PMID: 22681171.
108. Martin LT, McNamara MJ, Milot AS, Halle T, Hair EC. The effects of father involvement during pregnancy on receipt of prenatal care and maternal smoking. Maternal and child health journal. 2007 Nov;11(6):595-602. PubMed PMID: 17557201.
109. Teitler JO. Father Involvement, Child Health and Maternal Health Behavior. Children and Youth Services Review. 2001;23(4/5):403-25.
110. Bullock LF, Browning C, Geden E. Telephone social support for low-income pregnant women. Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG. 2002 Nov-Dec;31(6):658-64. PubMed PMID: 12465861.
111. Hudson DB, Campbell-Grossman C, Keating-Lefler R, Carraher S, Gehle J, Heusinkvelt S. Online support for single, low-income, African American mothers. MCN The American journal of maternal child nursing. 2009 Nov-Dec;34(6):350-5. PubMed PMID: 19901696.
112. McNeil DA, Vekved M, Dolan SM, Siever J, Horn S, Tough SC. Getting more than they realized they needed: a qualitative study of women's experience of group prenatal care. BMC pregnancy and childbirth. 2012;12:17. PubMed PMID: 22436393. Pubmed Central PMCID: 3364900.
113. Novick G, Sadler LS, Knafl KA, Groce NE, Kennedy HP. The intersection of everyday life and group prenatal care for women in two urban clinics. Journal of health care for the poor and underserved. 2012 May;23(2):589-603. PubMed PMID: 22643609. Pubmed Central PMCID: 3625534.
114. Katz KS, Jarrett MH, El-Mohandes AA, Schneider S, McNeely-Johnson D, Kiely M. Effectiveness of a combined home visiting and group intervention for low income African American mothers: the pride in parenting program. Maternal and child health journal. 2011 Dec;15 Suppl 1:S75-84. PubMed PMID: 21792546.
115. Farahi N, Zolotor A. Recommendations for preconception counseling and care. American family physician. 2013 Oct 15;88(8):499-506. PubMed PMID: 24364570.

116. Field T, Diego M, Hernandez-Reif M. Prenatal depression effects and interventions: a review. Infant behavior & development. 2010 Dec;33(4):409-18. PubMed PMID: 20471091. Pubmed Central PMCID: 2933409.
117. Christian LM. Effects of stress and depression on inflammatory immune parameters in pregnancy. American journal of obstetrics and gynecology. 2014 Sep;211(3):275-7. PubMed PMID: 24956551. Pubmed Central PMCID: 4159131.
118. Davalos DB, Yadon CA, Tregellas HC. Untreated prenatal maternal depression and the potential risks to offspring: a review. Arch Womens Ment Health. 2012 Feb;15(1):1-14. PubMed PMID: 22215285. Epub 2012/01/05. eng.
119. Fowles ER, Stang J, Bryant M, Kim S. Stress, depression, social support, and eating habits reduce diet quality in the first trimester in low-income women: a pilot study. Journal of the Academy of Nutrition and Dietetics. 2012 Oct;112(10):1619-25. PubMed PMID: 23017572. Pubmed Central PMCID: 3463107.
120. Orr ST, Blazer DG, James SA, Reiter JP. Depressive symptoms and indicators of maternal health status during pregnancy. J Womens Health (Larchmt). 2007 May;16(4):535-42. PubMed PMID: 17521257.
121. Dailey DE. Social stressors and strengths as predictors of infant birth weight in low-income African American women. Nursing research. 2009 Sep-Oct;58(5):340-7. PubMed PMID: 19752674.
122. Godecker AL, Harrison PA, Sidebottom AC. Nurse versus community health worker identification of psychosocial risks in pregnancy through a structured interview. Journal of health care for the poor and underserved. 2013 Nov;24(4):1574-85. PubMed PMID: 24185153.
123. Harrison PA, Godecker A, Sidebottom AC. Psychosocial risk screening during pregnancy: additional risks identified during a second interview. Journal of health care for the poor and underserved. 2011 Nov;22(4):1344-57. PubMed PMID: 22080714. Epub 2011/11/15. eng.
124. Talge NM, Mudd LM, Sikorskii A, Basso O. United States birth weight reference corrected for implausible gestational age estimates. Pediatrics. 2014 May;133(5):844-53. PubMed PMID: 24777216.
125. Adewuya AO, Ola BA, Afolabi OO. Validity of the patient health questionnaire (PHQ-9) as a screening tool for depression amongst Nigerian university students. Journal of affective disorders. 2006 Nov;96(1-2):89-93. PubMed PMID: 16857265. Epub 2006/07/22. eng.
126. Huang FY, Chung H, Kroenke K, Delucchi KL, Spitzer RL. Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. J Gen Intern Med. 2006 Jun;21(6):547-52. PubMed PMID: 16808734. Pubmed Central PMCID: 1924626. Epub 2006/07/01. eng.
127. Lotrakul M, Sumrithe S, Saipanish R. Reliability and validity of the Thai version of the PHQ-9. BMC Psychiatry. 2008;8:46. PubMed PMID: 18570645. Pubmed Central PMCID: 2443128. Epub 2008/06/24. eng.
128. Martin A, Rief W, Klaiberg A, Braehler E. Validity of the Brief Patient Health Questionnaire Mood Scale (PHQ-9) in the general population. General hospital psychiatry. 2006 Jan-Feb;28(1):71-7. PubMed PMID: 16377369. Epub 2005/12/27. eng.
129. Monahan PO, Shacham E, Reece M, Kroenke K, Ong'or WO, Omollo O, et al. Validity/reliability of PHQ-9 and PHQ-2 depression scales among adults living with

HIV/AIDS in western Kenya. J Gen Intern Med. 2009 Feb;24(2):189-97. PubMed PMID: 19031037. Pubmed Central PMCID: 2629000. Epub 2008/11/26. eng.
130. Yeung A, Fung F, Yu SC, Vorono S, Ly M, Wu S, et al. Validation of the Patient Health Questionnaire-9 for depression screening among Chinese Americans. Compr Psychiatry. 2008 Mar-Apr;49(2):211-7. PubMed PMID: 18243896. Pubmed Central PMCID: 2268021. Epub 2008/02/05. eng.
131. Lisonkova S, Janssen PA, Sheps SB, Lee SK, Dahlgren L. The effect of maternal age on adverse birth outcomes: does parity matter? Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC. 2010 Jun;32(6):541-8. PubMed PMID: 20569534.
132. Forna F, Jamieson DJ, Sanders D, Lindsay MK. Pregnancy outcomes in foreign-born and US-born women. International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics. 2003 Dec;83(3):257-65. PubMed PMID: 14643035.
133. Shah PS, Zao J, Ali S, Knowledge Synthesis Group of Determinants of preterm LBWb. Maternal marital status and birth outcomes: a systematic review and meta-analyses. Maternal and child health journal. 2011 Oct;15(7):1097-109. PubMed PMID: 20690038.
134. Shah PS, Knowledge Synthesis Group on Determinants of LBWPTb. Parity and low birth weight and preterm birth: a systematic review and meta-analyses. Acta obstetricia et gynecologica Scandinavica. 2010 Jul;89(7):862-75. PubMed PMID: 20583931.
135. Shah NR, Bracken MB. A systematic review and meta-analysis of prospective studies on the association between maternal cigarette smoking and preterm delivery. American journal of obstetrics and gynecology. 2000 Feb;182(2):465-72. PubMed PMID: 10694353. Pubmed Central PMCID: 2706697.
136. Patra J, Bakker R, Irving H, Jaddoe VW, Malini S, Rehm J. Dose-response relationship between alcohol consumption before and during pregnancy and the risks of low birthweight, preterm birth and small for gestational age (SGA)-a systematic review and meta-analyses. BJOG : an international journal of obstetrics and gynaecology. 2011 Nov;118(12):1411-21. PubMed PMID: 21729235. Pubmed Central PMCID: 3394156.
137. Bailey BA, Sokol RJ. Pregnancy and alcohol use: evidence and recommendations for prenatal care. Clinical obstetrics and gynecology. 2008 Jun;51(2):436-44. PubMed PMID: 18463472.
138. Bailey BA. Partner violence during pregnancy: prevalence, effects, screening, and management. International journal of women's health. 2010;2:183-97. PubMed PMID: 21072311. Pubmed Central PMCID: 2971723.
139. Chambliss LR. Intimate partner violence and its implication for pregnancy. Clinical obstetrics and gynecology. 2008 Jun;51(2):385-97. PubMed PMID: 18463468.
140. Ivers LC, Cullen KA. Food insecurity: special considerations for women. The American journal of clinical nutrition. 2011 Dec;94(6):1740S-4S. PubMed PMID: 22089447. Pubmed Central PMCID: 3226027.
141. Copper RL, Goldenberg RL, Das A, Elder N, Swain M, Norman G, et al. The preterm prediction study: maternal stress is associated with spontaneous preterm birth at less than thirty-five weeks' gestation. National Institute of Child Health and Human

Development Maternal-Fetal Medicine Units Network. American journal of obstetrics and gynecology. 1996 Nov;175(5):1286-92. PubMed PMID: 8942502.
142. Dole N, Savitz DA, Hertz-Picciotto I, Siega-Riz AM, McMahon MJ, Buekens P. Maternal stress and preterm birth. American journal of epidemiology. 2003 Jan 1;157(1):14-24. PubMed PMID: 12505886.
143. Gavin AR, Holzman C, Siefert K, Tian Y. Maternal depressive symptoms, depression, and psychiatric medication use in relation to risk of preterm delivery. Women's health issues : official publication of the Jacobs Institute of Women's Health. 2009 Sep-Oct;19(5):325-34. PubMed PMID: 19733802. Pubmed Central PMCID: 2839867.
144. Goldenberg RL, Cliver SP, Mulvihill FX, Hickey CA, Hoffman HJ, Klerman LV, et al. Medical, psychosocial, and behavioral risk factors do not explain the increased risk for low birth weight among black women. American journal of obstetrics and gynecology. 1996 Nov;175(5):1317-24. PubMed PMID: 8942508.
145. Hoffman S, Hatch MC. Depressive symptomatology during pregnancy: evidence for an association with decreased fetal growth in pregnancies of lower social class women. Health psychology : official journal of the Division of Health Psychology, American Psychological Association. 2000 Nov;19(6):535-43. PubMed PMID: 11129356.
146. Li D, Liu L, Odouli R. Presence of depressive symptoms during early pregnancy and the risk of preterm delivery: a prospective cohort study. Human reproduction. 2009 Jan;24(1):146-53. PubMed PMID: 18948314.
147. Neggers Y, Goldenberg R, Cliver S, Hauth J. The relationship between psychosocial profile, health practices, and pregnancy outcomes. Acta obstetricia et gynecologica Scandinavica. 2006;85(3):277-85. PubMed PMID: 16553174.
148. Rogal SS, Poschman K, Belanger K, Howell HB, Smith MV, Medina J, et al. Effects of posttraumatic stress disorder on pregnancy outcomes. Journal of affective disorders. 2007 Sep;102(1-3):137-43. PubMed PMID: 17291588. Pubmed Central PMCID: 2150994.
149. Smith MV, Shao L, Howell H, Lin H, Yonkers KA. Perinatal depression and birth outcomes in a Healthy Start project. Maternal and child health journal. 2011 Apr;15(3):401-9. PubMed PMID: 20300813. Pubmed Central PMCID: 3757503.
150. Steer RA, Scholl TO, Hediger ML, Fischer RL. Self-reported depression and negative pregnancy outcomes. Journal of clinical epidemiology. 1992 Oct;45(10):1093-9. PubMed PMID: 1474405. Epub 1992/10/01. eng.
151. Straub H, Adams M, Kim JJ, Silver RK. Antenatal depressive symptoms increase the likelihood of preterm birth. American journal of obstetrics and gynecology. 2012 Oct;207(4):329 e1-4. PubMed PMID: 22789523.
152. El-Mohandes AA, Kiely M, Gantz MG, El-Khorazaty MN. Very preterm birth is reduced in women receiving an integrated behavioral intervention: a randomized controlled trial. Maternal and child health journal. 2011 Jan;15(1):19-28. PubMed PMID: 20082130. Pubmed Central PMCID: 2988881.
153. Nuckolls KB, Kaplan BH, Cassel J. Psychosocial assets, life crisis and the prognosis of pregnancy. American journal of epidemiology. 1972 May;95(5):431-41. PubMed PMID: 5021933.

154. Norbeck JS, Tilden VP. Life stress, social support, and emotional disequilibrium in complications of pregnancy: a prospective, multivariate study. Journal of health and social behavior. 1983 Mar;24(1):30-46. PubMed PMID: 6853997.
155. Berkowitz GS, Kasl SV. The role of psychosocial factors in spontaneous preterm delivery. Journal of psychosomatic research. 1983;27(4):283-90. PubMed PMID: 6620204.
156. Pagel MD, Smilkstein G, Regen H, Montano D. Psychosocial influences on new born outcomes: a controlled prospective study. Social science & medicine. 1990;30(5):597-604. PubMed PMID: 2309138.
157. Turner RJ, Grindstaff CF, Phillips N. Social support and outcome in teenage pregnancy. Journal of health and social behavior. 1990 Mar;31(1):43-57. PubMed PMID: 2313076.
158. Norbeck JS, Anderson NJ. Psychosocial predictors of pregnancy outcomes in low-income black, Hispanic, and white women. Nursing research. 1989 Jul-Aug;38(4):204-9. PubMed PMID: 2748353.
159. Hedegaard M, Henriksen TB, Secher NJ, Hatch MC, Sabroe S. Do stressful life events affect duration of gestation and risk of preterm delivery? Epidemiology. 1996 Jul;7(4):339-45. PubMed PMID: 8793357.
160. Dejin-Karlsson E, Hanson BS, Ostergren PO, Lindgren A, Sjoberg NO, Marsal K. Association of a lack of psychosocial resources and the risk of giving birth to small for gestational age infants: a stress hypothesis. BJOG : an international journal of obstetrics and gynaecology. 2000 Jan;107(1):89-100. PubMed PMID: 10645867.
161. Campos B, Schetter CD, Abdou CM, Hobel CJ, Glynn LM, Sandman CA. Familialism, social support, and stress: positive implications for pregnant Latinas. Cultural diversity & ethnic minority psychology. 2008 Apr;14(2):155-62. PubMed PMID: 18426288. Pubmed Central PMCID: 2859297.
162. Andrade SE, Scott PE, Davis RL, Li DK, Getahun D, Cheetham TC, et al. Validity of health plan and birth certificate data for pregnancy research. Pharmacoepidemiology and drug safety. 2013 Jan;22(1):7-15. PubMed PMID: 22753079. Pubmed Central PMCID: 3492503.
163. Buescher PA, Taylor KP, Davis MH, Bowling JM. The quality of the new birth certificate data: a validation study in North Carolina. American journal of public health. 1993 Aug;83(8):1163-5. PubMed PMID: 8342728. Pubmed Central PMCID: 1695166.
164. Jones RK, Jerman J. Abortion incidence and service availability in the United States, 2011. Perspectives on sexual and reproductive health. 2014 Mar;46(1):3-14. PubMed PMID: 24494995.
165. Regan L, Rai R. Epidemiology and the medical causes of miscarriage. Bailliere's best practice & research Clinical obstetrics & gynaecology. 2000 Oct;14(5):839-54. PubMed PMID: 11023804.
166. Bonari L, Bennett H, Einarson A, Koren G. Risks of untreated depression during pregnancy. Can Fam Physician. 2004 Jan;50:37-9. PubMed PMID: 14761100. Pubmed Central PMCID: 2214485. Epub 2004/02/06. eng.
167. Kingston D, Tough S, Whitfield H. Prenatal and Postpartum Maternal Psychological Distress and Infant Development: A Systematic Review. Child Psychiatry Hum Dev. 2012 Mar 10. PubMed PMID: 22407278. Epub 2012/03/13. Eng.

168. Barnet B, Joffe A, Duggan AK, Wilson MD, Repke JT. Depressive symptoms, stress, and social support in pregnant and postpartum adolescents. Arch Pediatr Adolesc Med. 1996 Jan;150(1):64-9. PubMed PMID: 8542009. Epub 1996/01/01. eng.
169. Milgrom J, Gemmill AW, Bilszta JL, Hayes B, Barnett B, Brooks J, et al. Antenatal risk factors for postnatal depression: a large prospective study. Journal of affective disorders. 2008 May;108(1-2):147-57. PubMed PMID: 18067974. Epub 2007/12/11. eng.
170. Mohammad KI, Gamble J, Creedy DK. Prevalence and factors associated with the development of antenatal and postnatal depression among Jordanian women. Midwifery. 2011 Dec;27(6):e238-45. PubMed PMID: 21130548. Epub 2010/12/07. eng.
171. Lancaster CA, Gold KJ, Flynn HA, Yoo H, Marcus SM, Davis MM. Risk factors for depressive symptoms during pregnancy: a systematic review. American journal of obstetrics and gynecology. 2010 Jan;202(1):5-14. PubMed PMID: 20096252. Pubmed Central PMCID: 2919747. Epub 2010/01/26. eng.
172. Beck CT. Predictors of postpartum depression: an update. Nursing research. 2001 Sep-Oct;50(5):275-85. PubMed PMID: 11570712. Epub 2001/09/26. eng.
173. Gross KH, Wells CS, Radigan-Garcia A, Dietz PM. Correlates of self-reports of being very depressed in the months after delivery: results from the Pregnancy Risk Assessment Monitoring System. Maternal and child health journal. 2002 Dec;6(4):247-53. PubMed PMID: 12512766. Epub 2003/01/07. eng.
174. Nielsen Forman D, Videbech P, Hedegaard M, Dalby Salvig J, Secher NJ. Postpartum depression: identification of women at risk. BJOG : an international journal of obstetrics and gynaecology. 2000 Oct;107(10):1210-7. PubMed PMID: 11028570. Epub 2000/10/12. eng.
175. Brugha TS, Sharp HM, Cooper SA, Weisender C, Britto D, Shinkwin R, et al. The Leicester 500 Project. Social support and the development of postnatal depressive symptoms, a prospective cohort survey. Psychol Med. 1998 Jan;28(1):63-79. PubMed PMID: 9483684. Epub 1998/03/04. eng.
176. Jane-Llopis E, Matytsina I. Mental health and alcohol, drugs and tobacco: a review of the comorbidity between mental disorders and the use of alcohol, tobacco and illicit drugs. Drug Alcohol Rev. 2006 Nov;25(6):515-36. PubMed PMID: 17132571. Epub 2006/11/30. eng.
177. Ross LE, Dennis CL. The prevalence of postpartum depression among women with substance use, an abuse history, or chronic illness: a systematic review. J Womens Health (Larchmt). 2009 Apr;18(4):475-86. PubMed PMID: 19361314. Epub 2009/04/14. eng.
178. Seyfried LS, Marcus SM. Postpartum mood disorders. Int Rev Psychiatry. 2003 Aug;15(3):231-42. PubMed PMID: 15276962. Epub 2004/07/28. eng.
179. Kroenke K, Spitzer RL, Williams JB, Lowe B. The Patient Health Questionnaire Somatic, Anxiety, and Depressive Symptom Scales: a systematic review. General hospital psychiatry. 2010 Jul-Aug;32(4):345-59. PubMed PMID: 20633738. Epub 2010/07/17. eng.
180. Gjerdingen D, Crow S, McGovern P, Miner M, Center B. Postpartum depression screening at well-child visits: validity of a 2-question screen and the PHQ-9. Ann Fam Med. 2009 Jan-Feb;7(1):63-70. PubMed PMID: 19139451. Pubmed Central PMCID: 2625843. Epub 2009/01/14. eng.

181. Hanusa BH, Scholle SH, Haskett RF, Spadaro K, Wisner KL. Screening for depression in the postpartum period: a comparison of three instruments. J Womens Health (Larchmt). 2008 May;17(4):585-96. PubMed PMID: 18345995. Epub 2008/03/19. eng.
182. Weobong B, Akpalu B, Doku V, Owusu-Agyei S, Hurt L, Kirkwood B, et al. The comparative validity of screening scales for postnatal common mental disorder in Kintampo, Ghana. Journal of affective disorders. 2009 Feb;113(1-2):109-17. PubMed PMID: 18614241. Epub 2008/07/11. eng.
183. Flynn HA, Sexton M, Ratliff S, Porter K, Zivin K. Comparative performance of the Edinburgh Postnatal Depression Scale and the Patient Health Questionnaire-9 in pregnant and postpartum women seeking psychiatric services. Psychiatry Res. 2011 May 15;187(1-2):130-4. PubMed PMID: 21122923. Epub 2010/12/03. eng.
184. Yawn BP, Pace W, Wollan PC, Bertram S, Kurland M, Graham D, et al. Concordance of Edinburgh Postnatal Depression Scale (EPDS) and Patient Health Questionnaire (PHQ-9) to assess increased risk of depression among postpartum women. J Am Board Fam Med. 2009 Sep-Oct;22(5):483-91. PubMed PMID: 19734393. Epub 2009/09/08. eng.
185. Neter E, Collins NL, Lobel M, Dunkel-Schetter C. Psychosocial predictors of postpartum depressed mood in socioeconomically disadvantaged women. Womens Health. 1995 Spring;1(1):51-75. PubMed PMID: 9373373. Epub 1995/04/01. eng.
186. Roggman LA, Cook GA, Peterson CA, Raikes HH. Who drops out of Early Head Start home visiting programs. Early Educ Develop. 2008;19:574-99.
187. Katz KS, El-Mohandes PA, Johnson DM, Jarrett PM, Rose A, Cober M. Retention of low income mothers in a parenting intervention study. Journal of community health. 2001 Jun;26(3):203-18. PubMed PMID: 11478566. Epub 2001/08/02. eng.
188. O'Brien RA, Moritz P, Luckey DW, McClatchey MW, Ingoldsby EM, Olds DL. Mixed methods analysis of participant attrition in the nurse-family partnership. Prevention science : the official journal of the Society for Prevention Research. 2012 Jun;13(3):219-28. PubMed PMID: 22562646. Pubmed Central PMCID: 3596156. Epub 2012/05/09. eng.
189. Bitler M, Gunderson C, Marquis G. Are WIC non-recipients at less nutritional risk than recipients? An application of the food security measure. Rev Agricult Econ. 2005;27:433-8.
190. Herman DR, Harrison GG, Jenks E. The effeect of the WIC program on food security status of pregnant, first-time participants. Fam Econ Nutr REv. 2004;16:21-9.
191. Laraia BA, Borja JB, Bentley ME. Grandmothers, fathers, and depressive symptoms are associated with food insecurity among low-income first-time African-American mothers in North Carolina. Journal of the American Dietetic Association. 2009 Jun;109(6):1042-7. PubMed PMID: 19465186. Pubmed Central PMCID: 2727704. Epub 2009/05/26. eng.
192. Laraia BA, Siega-Riz AM, Gundersen C, Dole N. Psychosocial factors and socioeconomic indicators are associated with household food insecurity among pregnant women. The Journal of nutrition. 2006 Jan;136(1):177-82. PubMed PMID: 16365079. Epub 2005/12/21. eng.

193. Borders AE, Grobman WA, Amsden LB, Holl JL. Chronic stress and low birth weight neonates in a low-income population of women. Obstetrics and gynecology. 2007 Feb;109(2 Pt 1):331-8. PubMed PMID: 17267833. Epub 2007/02/03. eng.
194. Carmichael SL, Yang W, Herring A, Abrams B, Shaw GM. Maternal food insecurity is associated with increased risk of certain birth defects. The Journal of nutrition. 2007 Sep;137(9):2087-92. PubMed PMID: 17709447. Pubmed Central PMCID: 2063452. Epub 2007/08/22. eng.
195. Hromi-Fiedler A, Bermudez-Millan A, Segura-Perez S, Perez-Escamilla R. Household food insecurity is associated with depressive symptoms among low-income pregnant Latinas. Maternal & child nutrition. 2011 Oct;7(4):421-30. PubMed PMID: 20735732. Pubmed Central PMCID: 3008302. Epub 2010/08/26. eng.
196. Hromi-Fiedler A, Bermudez-Millan A, Segura-Perez S, Damio G, Perez-Escamilla R. Adaptation of the U.S. Household Food Security Survey Module for low-income pregnant Latinas: qualitative phase. J Hunger Environ Nutri. 2009;4:62-80.
197. Gavin NI, Gaynes BN, Lohr KN, Meltzer-Brody S, Gartlehner G, Swinson T. Perinatal depression: a systematic review of prevalence and incidence. Obstetrics and gynecology. 2005 Nov;106(5 Pt 1):1071-83. PubMed PMID: 16260528.

Appendix A. Prenatal Risk Overview (PRO)

Lack of telephone access
When you are at home, how often do you have access to a telephone?

○ All the time ○ Some of the time ○ Rarely ○ None of the time

Lack of transportation access
How often do you have access to transportation?

○ All the time ○ Some of the time ○ Rarely ○ None of the time

Food insecurity
IN THE PAST 12 MONTHS ...

How often did the food that you bought not last, and you didn't have money to buy more?

○ Often ○ Some times ○ Never

How often could you not afford to eat balanced meals?

○ Often ○ Some times ○ Never

How often did you cut the size of your meals or skip meals because there wasn't enough money for food?

○ Often ○ Some times ○ Never

How often were you hungry but didn't eat because you couldn't afford enough food?

○ Often ○ Some times ○ Never

Housing instability
IN THE PAST 12 MONTHS . . .

How many months did you live with relatives or friends as a temporary living arrangement?

0 1 2 3 4 5 6 7 8 9 10 11 12

How many nights did you stay in a shelter or other temporary facility?

___ ___ ___ (0-365)

Are you currently living in a stable housing situation?

○ Very Stable ○ Somewhat stable ○ Not stable

How concerned are you that you won't have a place to live when your baby is born?

○ Very Concerned ○ Somewhat concerned ○ Not concerned

Lack of social support

How many people can you count on in times of need?

0 1 2 3 4 5 6 7 8 9 10 or more

How many people would be able to take care of your child(ren) for several hours if needed?

0 1 2 3 4 5 6 7 8 9 10 or more

Do you have a boyfriend or husband (or partner)?

○ No ○ Yes

[If yes] How satisfied are you with the way your (boyfriend/husband/partner) lets you know what he (she) feels or thinks?

○ Very satisfied ○ Somewhat satisfied ○ Somewhat unsatisfied ○ Very unsatisfied

Are there adults, not including your (boyfriend/husband/partner), with whom you have regular talks?

○ No ○ Yes

[If yes] Think about the person you talk with the most. How satisfied are you with the talks that you have with this person?

○ Very satisfied ○ Somewhat satisfied ○ Somewhat unsatisfied ○ Very unsatisfied

Intimate partner violence and other physical/sexual abuse

DURING THE 12 MONTHS BEFORE YOU KNEW YOU WERE PREGNANT, were you hit, slapped, kicked, or otherwise physically hurt by your (boyfriend/husband/partner)?

○ Yes ○ No

... by anyone else

○ Yes ○ No

SINCE YOU'VE BEEN PREGNANT, have you been hit, slapped, kicked, or otherwise physically hurt by your (boyfriend/husband/partner)?

○ Yes ○ No

... by anyone else

○ Yes ○ No

DURING THE 12 MONTHS BEFORE YOU KNEW YOU WERE PREGNANT, did your boyfriend/ husband/partner) force you to have sex?

○ Yes ○ No

Did anyone else force you to have sex?

○ Yes ○ No

SINCE YOU HAVE BEEN PREGNANT, has your (boyfriend/husband/partner) forced you to have sex?

○ Yes ○ No

Has anyone else forced you to have sex?

○ Yes ○ No

DURING THE 12 MONTHS BEFORE YOU KNEW YOU WERE PREGNANT, were you afraid that your (boyfriend/husband/partner) might hurt you?

○ Yes ○ No

Have you been afraid that anyone else might hurt you?

○ Yes ○ No

SINCE YOU HAVE BEEN PREGNANT, have you been afraid that your (boyfriend/husband/partner) might hurt you?

○ Yes ○ No

Have you been afraid that anyone else might hurt you?

○ Yes ○ No

Depression

OVER THE PAST 2 WEEKS ...

How often have you been bothered by any of the following problems?

Little interest or pleasure in doing things?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Feeling down, depressed, or hopeless?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Trouble falling asleep or staying sleep, or sleeping too much?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Feeling tired or having little energy?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Poor appetite or overeating?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Feeling bad about yourself – or that you are a failure or have let yourself or your family down?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Trouble concentrating on things, such as reading the newspaper or watching television?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Moving or speaking so slowly that other people could have noticed?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Being so fidgety or restless that you have been moving around a lot more than usual?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Thoughts that you would be better off dead, or thoughts of hurting yourself?

○ Not at all ○ Several days ○ More than half the days ○ Every day or nearly every day

Cigarette smoking

During the month before you knew you were pregnant, how many days a week did you smoke all or part of a cigarette?

○Daily (5-7 days/week)
○Less than Daily (1-4 days/week)
○Not at all (0 days)

On the days you smoked cigarettes, how many cigarettes did you smoke per day, on average?

○less than1, or 1
○2-5
○6-15 (about 1/2 pack)
○16 or more (about a pack or more)

Since you have known you were pregnant, how many days a week did you smoke all or part of a cigarette?

○Daily (5-7 days/week)
○Less than Daily (1-4 days/week)
○Not at all (0 days)

On the days you smoked cigarettes, how many cigarettes did you smoke per day, on average?
○less than1, or 1
○2-5
○6-15 (about 1/2 pack)
○16 or more (about a pack or more)

Alcohol use

DURING THE 12 MONTHS BEFORE YOU KNEW YOU WERE PREGNANT...

On how many days did you drink an alcoholic beverage?

○ Daily [260-365 total days or 5-7 days/week or 20-30 days/month]
○ Weekly [50-259 total days or 1-4 days/week or 4-19 days/month]
○ Monthly [12-49 total days or 1-3 days/month]
○ Rarely [1-11 total days]
○ Never [0 days]

On the days that you drank, how many drinks did you usually have each day?
_____ (Average # drinks per day)

Did you have a feeling of guilt or remorse after drinking?

○ Yes ○ No

Did a friend or family member tell you about things you said or did while you were drinking that you could not remember?

○ Yes ○ No

Did you neglect any of your responsibilities because of alcohol use?

○ Yes ○ No

Did you take a drink in the morning when you first got up?

○ Yes ○ No

SINCE YOU HAVE KNOWN YOU WERE PREGNANT, on how many days did you drink an alcoholic beverage?

○ Daily [5-7 days/week or 20-30 days/month]
○ Weekly [1-4 days/week or 4-19 days/month]
○ Monthly [1-3 days/month]
○ Rarely [Less than once a month]
○ Never [0 days]

On the days that you drank, how many drinks did you usually have each day?
_____(Average # drinks per day)

Drug use

DURING THE 12 MONTHS BEFORE YOU KNEW YOU WERE PREGNANT, on how many days did you use marijuana or any other drug not prescribed for you by your doctor?

- ○ Daily [260-365 total days or 5-7 days/week or 20-30 days/month]
- ○ Weekly [50-259 total days or 1-4 days/week or 4-19 days/month]
- ○ Monthly [12-49 total days or 1-3 days/month]
- ○ Rarely [1-11 total days]
- ○ Never [0 days]

During the past 12 months have you neglected any of your responsibilities because of drug use?

○ Yes ○ No

SINCE YOU HAVE KNOWN YOU WERE PREGNANT, on how many days did you use marijuana or any other drug not prescribed for you by your doctor?

- ○ Daily [5-7 days/week or 20-30 days/month]
- ○ Weekly [1-4 days/week or 4-19 days/month]
- ○ Monthly [1-3 days/month]
- ○ Rarely [Less than once a month]
- ○ Never [0 days]

Legal system involvement

Do you currently have any legal problems or are you on probation or parole?

○ Yes ○ No

Child protection involvement

Are you currently involved with the child protection system?

○ Yes ○ No

[If no] Have you ever been involved with the child protective system or had children removed from your home?

○ Yes ○ No

Appendix B. Postpartum Risk Overview (PPRO)

Housing instability

During pregnancy or since your baby was born, how many nights did you stay in a shelter or other temporary facility?

___ ___ ___ (0-365)

Are you currently living in a stable housing situation?

○ Very Stable ○ Somewhat stable ○ Not stable

Lack of social support

How many people can you count on in times of need?

0 1 2 3 4 5 6 7 8 9 10 or more

How many people would be able to take care of your child(ren) for several hours if needed?

0 1 2 3 4 5 6 7 8 9 10 or more

Intimate partner violence and other physical/sexual abuse

During pregnancy or since your baby was born, have you been hit, slapped, kicked, or otherwise physically hurt by your (boyfriend/husband/partner)?

○ Yes ○ No

... by anyone else

○ Yes ○ No

During pregnancy or since your baby was born, has your (boyfriend/husband/partner) forced you to have sex?

○ Yes ○ No

Has anyone else forced you to have sex?

○ Yes ○ No

During pregnancy, or since your baby was born have you been afraid that your (boyfriend/husband/partner) might hurt you?

○ Yes ○ No

Have you been afraid that anyone else might hurt you?

○ Yes ○ No

Depression

OVER THE PAST 2 WEEKS ...

How often have you been bothered by any of the following problems?

Little interest or pleasure in doing things?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Feeling down, depressed, or hopeless?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Trouble falling asleep or staying sleep, or sleeping too much?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Feeling tired or having little energy?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Poor appetite or overeating?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Feeling bad about yourself – or that you are a failure or have let yourself or your family down?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Trouble concentrating on things, such as reading the newspaper or watching television?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Moving or speaking so slowly that other people could have noticed?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Being so fidgety or restless that you have been moving around a lot more than usual?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Thoughts that you would be better off dead, or thoughts of hurting yourself or your baby?

○ Not at all	○ Several days	○ More than half the days	○ Every day or nearly every day

Infant exposure to environmental tobacco smoke
During the last 30 days, how often did anyone smoke tobacco in your home?

____ days

During the last 30 days, how often did anyone smoke tobacco while your child was in the car?

____ days

Alcohol use
Since your baby was born, on how many days did you drink an alcoholic beverage?

- ○ Daily [5-7 days/week or 20-30 days/month]
- ○ Weekly 1-4 days/week or 4-19 days/month]
- ○ Monthly [12-49 total days or 1-3 days/month]
- ○ Rarely [1-11 total days]
- ○ Never [0 days]

On the days that you drank, how many drinks did you usually have each day?

_____ (Average # drinks per day)

Drug use
Since your baby was born, on how many days did you use marijuana or any other drug not prescribed for you by your doctor?

- ○ Daily [5-7 days/week or 20-30 days/month]
- ○ Weekly [1-4 days/week or 4-19 days/month]
- ○ Monthly [1-3 days/month]
- ○ Rarely [Less than once a month]
- ○ Never [0 days]