X. LITERATURE REVIEW

Assisted Reproductive Technology

Assisted reproductive technology (ART) is increasingly used in the United States to overcome a range of infertility disorders. It is comprised of a diverse set of treatment options, including in vitro fertilization (IVF), trans-cervical embryo transfer, gamete and zygote intra-fallopian transfer, oocyte donation, embryo cryopreservation, assisted hatching techniques applied to pre-implantation embryos, intra-cytoplasmic sperm injection (ICSI), pre-implantation genetic diagnosis and extended embryo culture (Schieve et al 2004). Currently there are over 400 centers performing assisted reproductive technology in the United States (Wright et al 2004).

Over 107,000 ART procedures were reported to the CDC in 2001. The largest number of procedures (75%) occurred among patients who used their own freshly fertilized embryos. Overall, 40% of the ART procedures that progressed to the embryo transfer stage resulted in a pregnancy, 33% of these resulted in a live birth, and 21% resulted in a singleton birth. The highest success rates resulted from ART procedures using donor eggs and freshly fertilized embryos; and the lowest rates were observed among those using the patient's eggs and thawed embryos. In Florida, over 4,500 ART procedures were begun in 2001, and of these, 3,756 progressed to the transfer stage. Over 1500 of these procedures resulted in pregnancies, with 1,310 live births and 1,832 infants born (the number of infants born supersedes the number of live births because of multiple births). Of the successful pregnancies, 54% of these were multiple births, and 9% resulted in triplets or more (Wright et al 2004).

Recently, more work has begun to assess the long-term affects of ART on both women and infants. Research on the safety of ART has lagged behind the continual progress in advancing the technology itself—this is due to a number of factors: namely that ART providers do not monitor or care for a woman once a pregnancy has begun; procedures are costly and many patients must cover the expenses themselves; many patients and providers feel pressure to maximize their chance for success within one single treatment (Schieve et al 2004).

Some studies have found increased rates of spontaneous abortion for ART conceived pregnancies (Balen et al 1993; Dickey et al 1996). Yet more recent work has demonstrated that spontaneous abortion rates were similar to women who did not use ART, although a select subset of ART pregnancies, those which use clomiphene for stimulation or used thawed embryos, had moderately elevated risks for spontaneous abortion (Schieve et al 2004). One of the most often discussed risks associated with ART is multiple births. In addition, numerous studies suggest that singleton births are at increased risk for low birth weight, very low birth weight, preterm birth and fetal growth restriction (Klemetti et al 2002; Schieve et al 2002; Westergaard et al 1999). In addition to ART's effects on birthweight and preterm delivery, recent work has argued these infants are at increased risk for various nonspecific adverse health outcomes, including: low Apgar scores, increased hospital stays, and perinatal mortality (Draper et al 1999; Klemetti et al 2002).

Also of increasing interest are the long-term effects on women who participated in ART. There are a number of reasons why women's health could be compromised after ART procedures—including the increased incidence of multiple births, operative deliveries, and the adverse effects of the drugs used in ovarian stimulation (Shelley et al 1999). Recent studies have demonstrated the use of fertility drugs with increased risk for cancer, particularly for ovarian cancer (Rossing et al 1994; Venn et al 1995).

Maternal Depression in Pregnancy

In recent years, the growing rates of depression in the United States have garnered national attention. Research notes that the prevalence of major depression is twice as high in women as in men and that the rate of depression among women increases drastically during adolescence (Le et al 2003). This incidence has led the Department of Health and Human Services to include depression as a national priority within the Healthy People 2010 Initiative (DHHS 2000). Depression is the most common of all mental illnesses and is recognized as one of the ten leading health indicators. According to the World Health Organization, major depression can be linked to 11% of all disability world-wide (Murray and Lopez 1996).

The rates of the first incidence of a major depressive episode reach a peak when women are in their childbearing years (Gotlib et al 1989; O'Hara et al 1991). Although there has been a lot of attention on the incidence of postpartum depression, antenatal depression has received a lot less attention both through medical research and the media. Yet antenatal depression is also associated with poor pregnancy outcomes. Pregnant women who are depressed during their pregnancy are more at-risk for anorexia, increased smoking and alcohol abuse (Zuckerman et al 1990). In addition, women who experience depressive episodes during pregnancy are less likely to get adequate prenatal care (Mertens et al 2001). Zuckerman et al 1989 has found that depressive symptoms in pregnancy are associated with increased life stress, decreased social support, poor weight gain and the use of cocaine.

Maternal age can be correlated with depressive incidents during the antenatal period. Deal and Holt (1998) demonstrated that adolescent mothers experience high rates of depressive symptoms relative to adult mothers. In their study, the antenatal depression among adolescent mothers was associated with Black race, unmarried status, low educational attainment and receipt of assistance.

Depression in pregnancy has been found to be associated with poor outcomes for the fetus as well. These women are more likely to have low birth weight infants and experience preterm deliveries (Dayan et al 2002; Field 2004; Steer et al 1992). Hedegaard et al (1993) found that psychological distress later in pregnancy is associated with the increased risk of a preterm delivery. This is mirrored by Orr et al (2002) who demonstrated that spontaneous preterm birth occurred among 12.7% of those women with a CES-D (Center for Epidemiologic Studies Depression) score in the upper 10^{th} percentile, and therefore concluded that maternal depressive symptoms in this sample of African-American women were independently associated with spontaneous preterm births. Depression in pregnancy is also associated with pre-eclampsia in the mother (Kurki et al 2000; Marcus et al 2003; Steer et al 1992). Lobel, Kaminer and Meyer (2000) argue that the effects of prenatal depression are attributable in

part to the pessimism that lead women to view their lives as stressful. They found that women who were least optimistic were more likely to deliver a low birth weight infant and those women who were more optimistic were more likely to exercise.

Unintended pregnancy is also associated with negative pregnancy outcomes. Orr and Miller (1997) investigated the psychosocial consequences of unintended pregnancy. Their data clearly demonstrated that women who have unintended pregnancies are more likely than those with intended pregnancies to experience high levels of exposure to psychosocial stressors and depressive symptoms.

Recent research has demonstrated that women who experience depressive episodes during the antenatal period are more likely to be depressive post-partum as well (Evan et al 2001; Hayes, Muller and Bradley 2001). Yonkers et al (2001) demonstrate that rates of postpartum depression are similar among Latina, African-American and Caucasian women, although little research has focused on these issues among minority women. More recent work has explored how postpartum depression knows no cultural boundaries: Baker et al (2005) found high rates of postpartum depression among Native Americans seeking maternal care in North Carolina. Edge, Baker and Rogers (2004) found that black Caribbean women experienced depressive symptoms in pregnancy and early motherhood, but were less likely than their white British counterparts to receive treatment.

Depression during the postpartum period can have negative consequences for the mother, the infant and the mother-infant relationship (Le et al 2003). Often times, the demands of the new infant cause women to feel overwhelmed, leading them to become stressed in the maternal role and disappointed in their experience of motherhood (O'Hara 1994, 1997). Women who are depressed during the postpartum period often report lower levels of self-efficacy, and higher rates of anxiety (Stuart, O'Hara and Blehar 1998; Teti and Gelfand 1991).

There are a number of studies which link negative child outcomes with postpartum depression. Infants of depressed mothers, when compared infants of non-depressed mothers, have slower cognitive development, are less securely attached and show greater behavioral difficulties (Hopkins et al 1987; Murray 1992; Murray et al 1996; Teti et al 1995). Field et al (2004) demonstrated that newborns of depressed mothers had less optimal habitation, orientation, motor, range of state, autonomic stability and depressed scores. Research has shown that postpartum depression is associated with negative mother-infant interactions, in which depressed mothers are less positive, more negative, less spontaneous and less responsive during interactions with their infants (Field 1995; Teti and Gelfand 1991). Rahman et al (2004) conclude that maternal depression in the prenatal and postnatal periods is a good predictor of poorer infant growth and a higher risk of diarrhea.

Domestic Violence

Domestic violence at any time during a person's life has problematic outcomes, but it can become particular grave during pregnancy. Although recent research has noted that "much of the literature on domestic violence overlooks abuse during pregnancy" (Burch and Gallup

2004:243), as an increasing number of states pass variations on the federal "Unborn Victims of Violence Act," and the media daily records incidence of fetal deaths due to domestic violence, one can imagine that this will become a key issue in reproductive health.

What literature that does exist on violence during pregnancy very clearly describes the negative impacts on both maternal and fetal outcomes. Some researchers argue that being pregnant does not put a woman more at-risk for abuse than before pregnancy, among most women, prevalence for abuse is less during pregnancy than before (Saltzman et al 2003; Martin et al 2004) and that in some cases, women may try to protect themselves by becoming pregnant (Hilberman and Munson 1978). Women most a risk for abuse during pregnancy are young, not White, unmarried, had less than 12 years of education, received Medicaid benefits or had unintended pregnancies (Peterson et al 1998; Tjaden and Thoennes 2000). Women reporting violence during pregnancy were also more likely to smoke or drink alcohol during their pregnancy, receive inadequate prenatal care, to be of higher parity and to have previously experienced a spontaneous abortion, induced abortion or fetal death (Saltzman et al 2003).

Yet other research argues that pregnancy is a stimulus for domestic violence, in some case violence is not simply continued into a pregnancy but initiated during pregnancy (Carlson-Gielen et al 1994; Hotaling et al 1988; McFarlane et al 1998). Burch and Gallup (2004) argue that abuse initiated during pregnancy may be a result of sexual jealousy and paternity fears. While some women may believe that pregnancy may protect them, it may be a false sense of security, in fact causing their partner to distrust the woman, and see the pregnancy as the result of an affair.

Martin et al (2004) demonstrate that while the onset of pregnancy did not stimulate any increase in physical violence, couples did report an increase in psychological aggression for both men and women. It appears that the stress and life changes brought about by a pregnancy may increase verbal arguing by a couple. Yet women did report an increase in sexual violence victimization.

Violence during pregnancy has problematic outcomes for both maternal and neonatal health. Domestic violence is responsible for more deaths in pregnant women than any single medical complication associated with pregnancy (Kady et al 2005; Liebschutz et al 2003). Prevalence of violence in pregnancy may surpass the prevalence of diabetes or preeclampsia (Kady et al 2005). Some research argues that assault during pregnancy is a significant immediate and long-term risk factor for low birth weight (Coker et al 2004; McFarlane et al 1996; Parker et al 1994; Valladares et al 2002). Abuse during pregnancy has also been found significantly associated with an increased risk of perinatal death and preterm births (Coker et al 2004; Covington et al 2001; Fernandez et al 1999).

Infant Mortality

Infant mortality remains a sensitive indicator of maternal and child health within a nation or community. It is associated with a number of factors, including pre-pregnancy maternal health, quality and access to medical care, socioeconomic factors and public health practices

(MaDorman et al 1994). Infant mortality is divided into three areas: early neonatal death from birth through 6 days; neonatal death which occurs from 7 days through 27 days; and postneonatal death, which occurs from day 28 through 364 (Hessol and Fuetes-Afflick 2005; MacDorman et al 2005).

In the United States, the most common causes of infant death relate to: congenital anomalies; sudden infant death syndrome; disorders relating to short gestation and low birth weight; respiratory distress syndrome; and newborn affected by maternal complications of pregnancy (MacDorman et al 1994).

While steady increases in prenatal care and perinatology as well as improvements in ante and postnatal care for high-risk infants have greatly decreased the infant mortality rate in the United States, there still remains a troubling gap in the rates in deaths between black and white infants (Headley 2004).

Throughout the twentieth century, infant mortality has been decreasing, but in 2002, the rate increased from 6.8 (per 1,000) to 7.0 (per 1,000). This is the first increase in the United States infant mortality rate in over forty years. Using the linked infant mortality and live birth files, researchers argue that this increase is primarily concentrated among neonatal period (Kochanex et al 2004; MacDorman et al 2005; Matthews et al 2004). This increase was not centered around one racial category, with the exception of American Indian mothers, infant mortality increased for all races/ethnicities in 2002 (MacDorman et al 2005).

Research using the linked files demonstrated that infant mortality significantly increased among two of the leading causes of death: disorders related to short gestation and low birthweight; and newborn affected by maternal complications of pregnancy. Nearly all of the infant deaths from these two causes during 2002 occurred to very low birthweight infants (98% and 95% respectively) and together with the evidence of the majority of deaths occurring during the early neonatal period leads researchers to conclude that birthweight may be the most important variable in the increase in infant mortality from 2001 to 2001 (MacDorman et al 2005).

Infant mortality rates in Miami-Dade County also reflect this increase. Infant mortality reached a historical low of 5.1 per 1,000 in 1999, yet steadily increased to 5.8 per 1,000 in 2000 and 2001 and 5.9 per 1,000 in 2002. Neonatal deaths account for 67.9% of the infant deaths in Miami-Dade County for 2002. While rates of infant mortality remain highest among Non-Hispanic Blacks in Miami-Dade, because of problems with registering race/ethnicity among Haitians, it is difficult to ascertain if the increase in deaths is solely among non-Hispanic Blacks or Haitians or with them combined (Maternal and Infant Health Indicators Highlights in Miami-Dade County, 2002).

Risk Factors for Infant Mortality

One of the most troubling aspects in investigating infant mortality is the persistent gap between rates of death of black and white infants. Countless studies have tried to designate one causal factor in high rates of infant mortality, but researchers disagree as to which is the

most salient cause (Headley 2004). This has led some to investigate maternal socioeconomic status (SES) as associated with infant death (Kreiger 1991; LaVeist 1993). By using traditional measures of SES, maternal education and income, there is an inverse association between SES and infant mortality—that is, as maternal education and income decrease, infant mortality rates increase. Yet similarly to work done in preterm birth and low birth weight, more researchers are emphasizing that even positive SES attributes do not work as a protective factor against high rates of infant mortality. This is particularly true when compared with white infants—that is, maternal postsecondary education does not appear to reduce infant deaths for black women to the same extent as it does for whites (Din-Dzietham and Hertz-Picciotto 1998; Singh and Yu 1995).

Much of the literature points to maternal behaviors during pregnancy as a predictor for infant mortality rates. A number of studies have found that Black women are less likely to smoke than white women during pregnancy (Beck et al 2002; Ebrahim et al 2000). Other studies have shown that African-American women's reported drug use is not greater than the use patterns reported among White women (Chasnoff et al 1990; Serdula et al 1991; Singh and Yu 1995). In fact, African-American women who did not smoke during pregnancy still had higher rates of infant mortality than white women who did (Matthews et al 2002).

Because traditional SES positive attributes do not function as a protective factor against infant deaths among African-Americans, it is important to investigate the literature on racism and poor birth outcomes. Some researchers argue that exposure to racism overrides the protective factor of maternal SES—while living in a better area reduces the risk of poor pregnancy outcomes among African-American women, living in an area in which they are a racial minority may increase this risk (Pickett et al 2005).

Acknowledging that the gap in infant mortality rates is not simply due to maternal SES factors, and that maternal experiences with racism seem to have an effect on low birth weight and preterm births, two of the major factors contributing to infant mortality, researchers have begun to postulate that birth outcomes are the consequences of experiences over the life course of women. This perspective calls for research that moves beyond comparing risk factors during pregnancy to understanding the cumulative effects of a life experiences on women's and infant's health. This method pays particular attention to racism, stress and behavioral factors as they occur across a woman's lifetime, recognizing that short-term behavioral modifications during pregnancy may not be enough to prevent infant death and other poor pregnancy outcomes (Lu and Halfon 2003).

One of the biggest contributing factors to infant mortality is preterm birth. The three causes of preterm delivery are thought to be: (1) preterm spontaneous labor, (2) premature rupture of membranes (PROM), and (3) medically indicated preterm birth due to maternal or fetal indication (Moutquin 2003; Mattison et al 2001). Preterm births are particularly linked to neonatal deaths (Smith 2005), and are considered to be the primary cause of infant mortality in the United States (Huddleston 1982; Kramer et al 2000). It important to evaluate the role of infection in the link between preterm birth and infant mortality (Fiscella 2004), as many researchers have elucidated the causal role that infection has in preterm birth (Bergstrom 2003; Culhane et al 2001; Friese 2003; Jarjoura et al 2005; Lamont 2003; Stevens et al 2004;

Yost and Cox 2000), and there has been increasing evidence that infections have an effect on vascular mechanisms (Salafia et al 1991; Salafia et al 1992).

Low birth weight (LBW) also remains one of the other strongest factors affecting infant mortality. Approximately 75% of neonatal deaths and 60% of all infant deaths affect low birth weight infants (Kilpatrick et al 1997). Yet as noted above, data from the 2002 linked live birth and infant death files demonstrates that the increasing infant mortality rates in the United States may be the result of deaths among low birth weight infants. Low birth weight suggests a history of fetal intrauterine stress, which may have resulted in intrauterine growth restriction (IUGR). Maternal behaviors have a great affect on birth weight; in particular maternal smoking has been highly associated with delivering LBW infants (Chan et al 2001; England et al 2001; Jacobson et al 1994; Phung et al 2003; Simpson 1957). Maternal nutrition is also an important risk factor for delivering a low birth weight infant, and has been linked to both eating disorders as well as obesity (Conti et al 1998; Jensen et al 2003; Kouda et al 2005; Kramer 2003). Of increasing interest is the use of assisted reproductive technology (ART), a series of studies have reported that (singleton) infants conceived through ART are at increased risk for low birth weight and very low birth weight (Klemetti et al 2002; Perri et al 2001; Schieve et al 2002; Wang et al 2002).

In addition to the use of technology in achieving conception, some research has argued that advances in perinatology technology are also associated with rates of infant mortality in the United States. Advances in technology have made it possible for women to deliver live infants under conditions which previously would have led to stillbirths. Infants born as early as 22 weeks are now able to be resuscitated (Frisbie et al 2004; Hack and Fanaroff 1993; Sowards 1997). During the 1990's, surfactant, used to speed neonatal pulmonary maturation, was made widely available in NICU's, as well as the increase use of antenatal steroids (also used to speed fetal pulmonary maturation) (Headley 2004). While these advances in perinatology technology had contributed to decreased rates of infant mortality due to preterm births, these decreases are not consistent across racial and ethnic categories. While some researchers argue this may be a result of access to care, other studies have found that these differences in rates of infant mortality rates by race/ethnicity persist even among all infants delivered at major medical centers with the same medical technology (Allen et al 2000; Hamvas et al 1996). Although it is clear that advances in perinatology have improved infant outcomes, it is difficult to understand the relationship between use of technology and poor outcomes.

Adequacy of prenatal care is an important variable in understanding infant mortality rates. Using the Kotelchuk Index, this indicator assesses whether any prenatal care was received, whether prenatal are was initiated during the first trimester of pregnancy, the average number of prenatal visits and components of initiation and receipt of prenatal care to determine if prenatal care was 'adequate.' This index is computed using vital statistics data. While this is a sensitive indicator of birth outcomes, researchers argue that 'adequate' prenatal does not translate directly into improved birth outcome (Headley 2004; Kogan et al 1993). Large scale studies have begun to evaluate the effect of prenatal care on birth outcomes. Recent work has demonstrated the success of Healthy Start programs nationwide in decreasing infant mortality rates (Devaney et al 2000; McCormick et al 2001; Moreno et al 2000). Vintzileos et

al (2002) demonstrated that prenatal care has an important impact in preventing postneonatal deaths, particularly in cases when the pregnancy has been complicated by postdates, pregnancy-induced hypertension or preterm labor.

Sudden Infant Death Syndrome (SIDS) is defined as the sudden death of an infant under one year of age which remains unexplained even after a thorough case investigation, a complete autopsy, the examination of the death scene and a review of the clinical history (Person, Lavezzi and Wolf 2002). In 1992, the American Academy of Paediatrics began recommending that infants sleep in the supine (versus the prone) position and this, combined with the "Back to Sleep" campaign has reduced the rates of SIDS by 40% (Kattwinkel et al 2000; Mesich et al 2005). While earlier work has demonstrated risk factors for infant deaths of SIDS are multiple births; preterm births; births to single mothers; births to mothers of low maternal age and infants slow to gain weight. Yet Chong et al (2004) argue that once these risk factors are controlled for, one of the key risk factors for death from SIDS is maternal smoking. The data is supported by other research which has demonstrated that infants of smoking mothers are less arousable (Chang et al 2003; Franco et al 1999; Lewis et al 1995).

Low Birth Weight

An infant's weight at birth is considered one of the most important predictors of its survival chances. Infants born less than 2500 grams (5 lbs, 8 oz) are considered *low birth weight* (LBW) and in turn, those born weighing less than 1500 grams (3 lbs, 4 oz) are considered *very low birth weight* (VLBW). Infants who are born LBW are either preterm (less than 37 weeks gestation) or small for gestational age (SGA), which is weighing in the smallest 10^{th} percentile for gestational age. In the 1970's researchers began to focus on the SGA infants by designating them as the result of intrauterine growth retardation (IUGR), therefore recognizing that these infants are not LBW because they were born preterm, but instead are considered smaller than fetuses of their same gestational age (Wilcox 2002). This review will focus on the risk factors associated with small for gestational age infants who are born low birth weight or very low birth weight.

Low birth weight in one of the greatest contributors to infant mortality and morbidity in the United States. Neonatal death is 40 times more likely among LBW infants and 200 times more likely among VLBW infants, as well as being at increased risk for neurological problems such as cerebral palsy, mental retardation, and lower respiratory tract conditions (Kiely et al 1994:185). Low birth weight has also been found to be associated with increased risk for childhood cancers (Daling et al 1984; Okcu et al 2002).

In addition to the public health consequences of low birth weight, there is an increasing amount of research which calculates the economic consequences of low birth weight. The high rates of mortality and morbidity related to low birth weight impose an immense burden on the health, education and social services, as well as on families (Petrou 2003). Yet beyond the economic consequences, there is increasing evidence that giving birth to a very low birth weight infant can have detrimental psychological consequences for mothers (O'Brien et al 1999; Wijnrocks 1999). Kersting et al (2004) argue that the situation of a mother who has

given birth to a VLBW infant is a complex, with a long-term traumatic event needing on-going emotional support beyond the perinatal period.

The number of infants born low birthweight declined in the United States from 1970 to 1980, but has been increasing slowly for the past 25 years (MacDorman et al 2005; Martin et al 2002). During 1980 and 2000, the percentage of LBW infants increased 11.8% and the number of VLBW infants increased 24.3% (MMWR 2002:589). Most recent estimates designate 1.5% of all births were VLBW and 7.8% were LBW during 2002 in the United States (MacDorman et al 2005:15; NVSR 2003:89).

Similarly to LBW rates in the nation, rates of infants born at low birth weights are on the rise in Miami-Dade County. The percent of LBW infants increased to 8.1% in 2002 from 7.9% in 1999 and up from 7.8% in 1991. Miami-Dade County continues to be higher than the national averages—the rate of LBW nation wide was 7.6% in 1999 and 7.1% in 1999. Comparably to the increasing rates nationwide, when broken down by Maternal Race/Ethnicity, overall most groups experienced a rate in low birth weight (Non-Hispanic White; Non-Hispanic Black). In Miami-Dade County, percentage of infants born low birth weight remains highest among Non-Hispanic Blacks, at 13% in 2002. By contrast, the rates among Hispanic mothers remained relatively stable and the rates decreased among Haitian mothers, from 11% in 1999 to 9.8% in 2002 (Florida Department of Health 2002).

Some of the most important risk factors for low birth weight infants are associated with maternal behaviors. One of the most studied and strongly implicated in the causation of low birth weight is cigarette smoking (Chan et al 2001; England et al 2001; Jacobson et al 1994; Phung et al 2003; Simpson 1957). Recent work has done nothing to disprove this association, Okah et al (2005) argue that this problem is particularly pronounced when combined with other health compromising behavior such as drug or alcohol use. These authors also note that women who use cigarettes during pregnancy are often more likely to engage in these other health-compromising behaviors. Lightwood et al (1999) argued that the use of smoking cessation classes aimed at ending smoking before the end of the first trimester could produce significant savings in the prevention of low birth weight infants.

In addition to the risk of maternal smoking, researchers are beginning to explore the association of environmental tobacco smoke (ETS) and low birth weight. Recent research has demonstrated that ETS indeed leads to diminished birth weight (Kharrazi et al 2004; National Cancer Institute 1999; Windham et al 1999; World Health Organization 1999). Kharrazi et al (2004) demonstrate that ETS exposure in pregnant women is associated with several adverse outcomes across the latter half of pregnancy among mothers who are presumed to be non-smokers. Although some of the low birth weight births were associated with preterm delivery, the majority were due to slowed growth in utero.

As noted earlier, maternal cigarette smoking is often very detrimental when combined with other health compromising behaviors such as alcohol or illicit drug use. Yet these substances can be problematic when used alone as well. Some researchers have argued that alcohol consumption has been shown to play important roles in association with low birth weight (Jones et al 1974; Little 1971; Virji 1991). Other researchers argue alcohol ingestion in

moderate amounts during pregnancy is not associated with low birth weight (O'Callaghan et al 2003) which in turn supports Okah et al's (2005) argument that health compromising behaviors are particularly detrimental when used in combination.

Other illicit drugs also have detrimental effects on fetal growth, including low birth weight, reduced birth length and small head circumference (Chouteau et al 1988; Little 1991; Petitti and Coleman 1990; Singer et al 1995; Volpe 1992). One of the most difficult issues in researching the effect of illicit drug use on the fetus is that maternal drug use is often difficult to disaggregate from various other maternal health-compromising behaviors. Drug-addicted mothers more often display psychological symptoms, as well as heightened levels of maternal stress, which often in turn contribute to poor fetal growth (Singer et al 2002).

Abuse during pregnancy is becoming an important risk factor in adverse pregnancy outcomes, including low birth weight (Campbell et al 1999; Murphy et al 2001). More recent work has developed the use of surveys in order to adequately measure abuse during pregnancy (Helton 1987). The mechanism(s) of association between abuse during pregnancy and birth weight are not clear—it could be the result of direct trauma to the abdomen (Newberger et al 1992) or the result of the underlying stress due to the abuse (Altrac et al 2002). Regardless of the causal mechanisms, research has demonstrated that injuries resulting from physical abuse during pregnancy are associated with the delivery of low birth weight infants (Neggers et al 2004).

The relation of being born low birth weight and infant mortality is troubling to researchers and policy makers. Of even more concern is the widening gap between Black and White infant mortality in the United States, with some researchers arguing that 63% of this gap is the result of African American infants being born low birth weight (Collins et al 2004: 2132). While this risk is not only associated with race, but often in conjunction with socioeconomic status (Kleinman and Kessel 1987) and education (Murray and Bernfield 1988). Yet increasingly research is demonstrating that the gap persists, even when controlled for maternal risk behaviors, and residence in non-impoverished neighborhoods (Berg et al 2001; Collins et al 1997; Pearl et al 2001). This has led some researchers to hypothesize that mother's experience in racism may in fact contribute to high rates of low birth weight infants among African Americans. Two recent studies have argued that the lifelong accumulated experiences of racial discrimination by African-American women constitute an independent risk factor for preterm delivery (Collins et al 2004; Mustillo et al 2004).

Keeping this argument in mind, low birth weight is therefore associated with race and lower socioeconomic status. But as researchers began to investigate rates of low birth weight infants in various communities in the United States, they made an interesting discovery. While Latina women are often considered of lower socioeconomic status than their white counterparts, they have similar rates of low birth weight births to whites. This has been entitled the "Latino Paradox," and is particularly evident among Latino mothers who are foreign-born (Fuentes-Afflick et al 1999; Scribner et al 1989; Singh and Yu 1996; Ventura et al 1985). Even after adjusting for other risk factors such as maternal behaviors, education, marital status, parity, etc... these rates do not differ between Latino women and White women (Fuentes-Afflick et al 1999). Researchers argue that more investigation is necessary

to understand the favorable pregnancy outcomes of foreign-born Latina women (Fuentes-Afflick et al 1998).

Various health conditions of the mother, either brought on by pregnancy, or pre-existent to pregnancy are also associated with low birth weight infants. Maternal hypertension acts as a stress in utero that increases the risk for intrauterine growth retardation as well as fetal death (Banias et al 1992; Kim et al 1996; Moore et al 1983; Sibai et al 1984). Anemia during pregnancy also increases risks of giving birth to a low birth weight infant (Kiley et al; Scanlon et al 2000) . Although anemia is more often associated with preterm birth, women who are anemic during pregnancy are at increased risk for delivering low birth weight infants (Yazdani et al 2003).

Maternal nutritional status has important effects on the growth of the fetus. Low pregnancy weight gain (for height) is often associated with low birth weight infants and has been linked to both poverty and eating disorders (Conti et al 1998; Kouda et al 2005; Kramer 2003). Poor weight gain is of particular concern in adolescent pregnancies, and reflects high rates low birth weight infants among this population (Rees et al 1992; Scholl et al 1992). Obesity also has negative associations with birth weight, with pre-pregnancy obesity often linked to hypertension, and therefore IUGR (Jensen et al 2003). Recent work has begun to explore the link between maternal nutrition during pregnancy, its correlation with low birth weight, and then eventual its lasting consequences on health (Moore and Davies 2005). There is now evidence that individuals who are small at birth are more at-risk for diabetes as well as cardiovascular disease later in life (Newsome et al 2003; Rich-Edwards et al 1997). And in addition to having lasting health consequences, women who were born LBW are more at-risk for delivering a LBW infant themselves (Klebanoff et al 1987; Sanderson et al 1995). Collins et al (2003) demonstrated that maternal low birth weight is a risk factor for infant low birth weight, independent of risk status during a current pregnancy.

Recent work has begun to pay more attention to the perinatal outcomes of infants conceived through assisted reproduction technology (ART). In the United States and worldwide, ART is increasingly being used to overcome fertility issues. Yet while ART provides benefits to many otherwise childless couples, a series of studies have reported that (singleton) infants conceived through ART are at increased risk for low birth weight and very low birth weight (Klemetti et al 2002; Perri et al 2001; Schieve et al 2002; Wang et al 2002). More recent work has argued that this risk has declined, particularly among small for gestational age infants, while preterm low birth weight risks have remained stable (Schieve et al 2004).

There is a large amount of literature demonstrating the link between utilization of prenatal care and low birth weight (Gorsky et al 1989; Hueston 1995; Kotelchuck 1994). While the bulk of this literature argues that prenatal care can help to reduce the risk of delivering a low birth weight infant, more recent work has begun to explore whether initiation of care has any affect on this risk. Hueston et al (2003) argue that there is no benefit for early (first trimester) initiation of prenatal care, instead that the differences among birth weights among women who start prenatal care later are in fact the result of confounding sociodemographic factors. Yet other work has demonstrated that the initiation of early WIC participation can have positive influences on birth weight outcomes (Lazariu-Bauer et al 2004). Reviewing the literature on prenatal care and birthweight demonstrates that while it is an important part of

the struggle to reduce rates of low birth weight and very low birth weight infants in the United States, it is also important to recognize the confounding factors, such as maternal demographics, behaviors and health, which can also affect birth weight. It is vital not to focus solely on one risk factor when designing interventions, but to assess the interaction of factors which affect women's risk for delivering low birth weigh infants.

Marital Status

The marital status of a pregnant woman has long been used as a risk factor in poor birth outcomes. While the stigma associated with unmarried childbearing has dissipated in the past few decades, there are still a number of adverse outcomes associated with unmarried mothers. Unmarried mothers often face greater economic insecurity than married mothers (Remez 1999; South 1999; *Zeitlin* et al 2002) and in some cases may receive less adequate prenatal care, especially when a pregnancy is unintended (Zeitlin et al 2002). Marital status is often divided into traditional marriage, cohabitation or common law marriage, or women living alone.

Live births to unmarried women have greatly increased over the past twenty years. In 1970, 10.7% of all live births were registered to unmarried women but by 2002, 34% of live births were registered to unmarried women. In Florida, 39.3% of live births were among unmarried women: 25.2% among white women; 65.8% among black women; and 39.5% among Hispanic women (NVSR 2003: 57). In addition, the distribution of live births to unmarried women by maternal age has also changed in the past twenty years. In 1970, 50.1% of these births occurred to women under 20 years of age; 31.8% among women 20-24; and 18.1% among women 25 years and older. In 2002, this distribution looked different: the majority of live births to unmarried women occurred among the 20-24 age group (38.5%), followed by the 25 and over at 35.9% and finally, 25.4% were under 20 years of age (Health 2004:117).

In general, research has demonstrated that "lone mothers," women living alone and raising their child(ren), have much poorer outcomes than either women in common law marriages or traditionally married women. It has been noted that these disparities, although modest in magnitude, have not diminished over time even though there is increasing social acceptance of single female households (Luo et al 2004). The risk for poor pregnancy outcomes among common law married women can be modified by ethnicity and maternal education. In one recent study, Luo et al (2004) found that minority women have much higher excess risks associated adverse birth outcomes where as higher maternal education mitigated the adverse effect of common law marriages. This is consistent with previous work demonstrating that reporting "unmarried" on the birth certificate did not affect the risk of infant mortality among infants born to college educated women (Matthews et al 2002).

Recent work in demography has demonstrated that there is a link between non-marital childbearing and education: women who have a higher propensity for non-marital conception also have a lower propensity to continue with their schooling (Upchurch et al 2002). Other research has argued that women in common law marriages are more likely to engage in adverse behaviors—such as smoking, which may also be related to poor pregnancy outcomes among this population (Luo et al 2004).

Women in "lone parenting" situations or common law marriages are more likely to have a preterm birth, a low birth weight infant, small for gestational age, as well as neonatal and postneonatal mortality (Bennet et al 1994; Hein et al 1990; Zeitlin et al 2002). Stillbirths are more common among single mothers than among women with partners (Smallwood 2004).

Maternal Age Literature Review: Mothers of Advanced Age and Teen Births

In an analysis of the risk factor 'maternal age' for negative fetal, neonatal and infant outcomes, it is important to look at both ends of the spectrum. There is a long history of research around the issue of teen pregnancy and parenting. More recently, researchers have begun to pay attention the number of births among older women as well.

Women are delaying childbearing for any number of reasons—most often in the pursuit of career or financial goals, better contraception, and advance education. Yet there are a number of adverse outcomes during pregnancy that are related to maternal age. It is generally assumed that women over age 35 are at increased risk for a number of pregnancy complications, particularly because of their age related risk for prepregnancy chronic diseases such as hypertension, diabetes, high parity, uterine myomas and a history of infertility (Dildy et al 1996). Katwijk and Peeters (1998) argue that there is an age-dependent rise in cardiovascular complications during pregnancy. The incidence of pregnancy induced hypertension as compared with 25-29 year olds, was double among the 30-35 year olds and three times as high in the >35 age group (Prysak et al 1995). Pre-eclampsia occurs more frequently in women with pre-existing hypertensive disorders, which as stated above, women higher in age are more likely to be hypertensive before pregnancy (Kaplan 1994). Diabetes can also become an issue for pregnant women of advanced age—in conditions of stress (such as pregnancy) asymptomatic type II diabetes may become symptomatic (Stout 1996). The American Council on Obstetrics and Gynecology (ACOG) recommends screening for gestational diabetes in all pregnant women over 30 years, in recognition of the strong positive relationship between gestational diabetes and age, the median rise between 25 years and 40 years being more than five-fold (Katwijk and Peeters 1998).

One of the other issues complicating late maternal age pregnancies is previous obstetric history. Recent work has demonstrated an association between previous poor outcomes, including fetal loss, preterm delivery and repeat spontaneous abortions (Buchmayer et al 2004; Frias et al 2004; Schiner et al 2004). In pregnant women of advanced maternal age, prenatal diagnosis is often recommended for the increase of chromosomal abnormalities after age 35. While amniocentesis, chorionic villus sampling and pre-implantation diagnosis are useful in determining birth defects, many women refuse prenatal diagnosis on the basis that they would not consider terminating the pregnancy even if they receive a positive diagnosis (Callaway et al 2005).

Much of the research on advanced maternal age focuses on the rate of cesareans among this population, particularly in the case of elective cesareans. Multiple studies show that pregnant women of advanced age are at high-risk for some form of operative delivery (Bianco et al 1996; Gilbert et al 1999; Ziadeh and Yahaya 2001). Lin and Xirasgar (2005) have

demonstrated higher rates of request cesarean deliveries among women of advanced maternal age.

The birth rate for teenagers (aged 15-19) declined steadily through the 1990's, from 62.1 births per 1,000 in 1991 to 48.5 per 1,000 in 2000, a reduction of 22%. The rate of teen births also declined in Florida, from 68.8 per 1,000 in 1991 to 52.6 per 1,000 in 2000, a reduction of 23.5% (Ventura et al 2002). Adolescent childbearing is also associated with a number of adverse outcomes, including low birth weight, preterm delivery and maternal and perinatal death (Fraser et al 1995; McCormick 1984). A number of studies have attempted to understand the risk factors associated with poor pregnancy outcomes among adolescents, and in comparison with adult women, young mothers are more likely to be psychosocially disadvantaged and biologically immature (Blankson et al 1993; Scholl et al 1987).

Race also has a negative impact on teen's experience with adolescent pregnancy. African-American adult women have a higher risk for many of the socio-economic factors associated with adverse birth outcomes, including anemia, lower socio-economic status, female headed households, fewer years of education, poorer nutrition, less access to prenatal care, higher incidence of sexually transmitted diseases, higher incidence of vaginal infections, and higher rates of pregnancy-induced hypertension (Chang et al 2003; Hulsey et al 1991; Johnson-Spear et al 1994).

One recent study (Chang et al 2003) compared the pregnancy outcomes of African-American teens to both adult African-American women as well as white teens. Rates of preeclampsia were higher among the African-American teens than both the adult black and white teens. This group also had a higher rate of both low birth weight and preterm birth than white teens. Young African-American pregnant teens showed an even higher rate of fetal deaths in comparison to other pregnant black women in this area. This group also had lower prenatal are utilization than the national rate, and there was a relationship between inadequate prenatal care and preterm birth with this community.

Maternal Education

Maternal education has long been considered as a important predictor of pregnancy outcomes, as well as having influence on overall fertility and birth spacing. The educational attainment of women giving birth in the United States has increased in the past 20 years. In 1970, the number of women completing 12 or more years of school was 69% and in 2002 that proportion was 78.5%, an increase of 14%. Even more dramatic is the increase in women completing 16 or more years of education, in 1970 that proportion 9% and in 2002, 25.9% of women giving birth had completed this much education (Martin et al 2003: 11). Of women who were born in the United States, 83.8% of these women giving birth had completed 12 or more years of schooling, whereas for mothers born outside of the United States, only 61.3% of them had completed 12 or more years of school (Martin et al 2003: 49).

Women with a higher educational background are more likely to desire as well as give birth to fewer children and are less likely to engage in health compromising behaviors. Women with more education are more likely to initiate breastfeeding (Beck et al 2002). Others have

speculated that maternal education can be correlated with change in behaviors—that is, educated mothers are more likely to be open to health promotion messages. This is particularly argued for mothers living in lesser developed countries where infant mortality is linked to diarrheal disease (Basu and Stephenson 2005; Miller 1993).

In addition, women who are well educated are more likely to attend childbirth education classes. Attendance at childbirth education classes is associated with a 75% increase in the odds that a child will be breastfed (Lu et al 2003). Finally, rates of maternal education is also associated with infant mortality. Infant mortality rates decline with increasing level of maternal education (MMWR 1989).

Prepregnancy Weight and Maternal Weight Gain

In the United States, obesity has become an increasing problem for both adult and children. Recent work by the CDC has demonstrated that based on body mass indexes (BMI) over 65% of American adults are considered overweight, and this is a 16% increase from the previous NHANES in 1988-1994 (NCHS Fact Sheet 2004 http://www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm). Castro and Avina (2002) point out the irony of obesity in the United States—where it overwhelming affects minority groups and those of lower socio-economic status—versus developing countries where obesity is associated with the wealthier classes.

Given the increasing rates of obesity in the United States, it is not surprising the rate of obesity is also rising among pregnant women as well. Ehrenberg et al (2002) recently evaluated the prevalence of obesity from January 1986 through June 2001 in an urban center. They found that the overall frequency of maternal obesity (> 200 lbs) was 23%, moderate obesity (201-250 lbs) was 17%, severe obesity (251-300 lbs) was 4.3% and extreme obesity (> 300 lbs) was 1.3%. These rates reflect an increase across all categories over time. The increased risk of maternal obesity is represented disproportionately in African-American women, who experienced a increase in risk of 42% over time, versus white women (29% increase), Hispanic women (26% increase) and Asian women (38% decrease) (Ehrenberg et al 2002: 1192).

Women's weight prepregnancy can have important impacts on maternal and fetal health—some researchers have argued that a maternal overweight condition can increase risks for poor pregnancy outcomes, in some cases creates greater risks than those associated with maternal weight gain during pregnancy (Stephansson et al 2001). In addition, excess weight gain during pregnancy can be difficult to shed in the postpartum period, and becomes an additional factor contributing to obesity in childbearing women (Castro and Avina 2002).

Howie et al (2003) used the CDC's 2000 natality file to compare the weight gain patterns of adolescents to those of adults. They focused particularly on excessive weight gain, which is defined as over 40 pounds through the course of a pregnancy. Their work demonstrated that adolescents were more likely to gain excessive weight, regardless of parity or race, as compared to their older counterparts.

Obese women are at-risk for a number of complications during pregnancy. Of particular cause for concern is the increased risk for hypertensive disorders during pregnancy. Because many obese women have pre-existing chronic hypertension, incidence of preeclampsia is often associated with higher BMI among pregnant women (Baeten et al 2001; Castro and Avina 2002; Strevens et al 2002). In addition, obese women have much higher rates of pregnancy-specific disorders as well—recent studies have reported a 2-4 fold increase in the incidence of pre-eclampsia even after controlling for preexisting hypertensive disorders (Bianco et al 1998; Sebire et al 2001). Obese women are also at increased risk for gestational diabetes, both because some women have the preexisting condition and for women without diabetes before pregnancy. Lu et al (2001) reported that close to 30% of cases of gestational diabetes within their institution were attributed to maternal obesity.

Other complications associated with obesity in pregnancy are respiratory problems, in particular asthma and sleep apnea (Maaasilta et al 2001). Pregnant women are at increase risk for thromboembolic disease, and obesity further increases this risk (Castro and Avina 2002). Complications associated with labor and delivery are also correlated with obesity during pregnancy. Even among low-risk women managed by providers, the risk for cesarean section was higher for obese women (Kaiser and Kirby 2001).

In addition to the maternal complications associated with pre-pregnancy obesity, there are also fetal, neonatal and childhood complications associated with maternal obesity. Multiple studies have confirmed the link between maternal obesity and neural tube defects (Shaw et al 1996; Shaw et al 2000; Werler et al 1996). Watkins et al (2003) found an association between maternal obesity and spina bifida, as well as heart defects in the neonate. While maternal obesity has been shown to reduce the risk of delivering a low birth weight infant, both prepregnancy obesity and excessive weight gain during pregnancy an increase the risk of delivery a large for gestational age infant (Andraesen et al 2004; Lederman 2001). In addition, obese women are more at-risk for late fetal deaths and preterm delivery (< 32 weeks gestation) (Cnattinggius et al 1998).

Also of concern during pregnancy is maternal weight gain, which is associated with at number of adverse outcomes for fetal and neonatal health. In women with a normal prepregnancy BMI, increase in a BMI category during pregnancy was associated with increased rates of gestational diabetes, lacerations, cesarean delivery and postpartum infections. The rate of low birth weight babies was also decreased among this population (Kabiru and Raynor 2004). Primiparous mother are more likely to gain an excessive amount of weight during pregnancy than multiparous (Howie et al 2003).

Preterm Birth

Preterm birth is the termination of pregnancy before 37 weeks of gestation. It is important to recognize the difference between preterm and birthweight, which led the National Council for Health Statistics to refine the World Health Organization's definition: "Infants who are premature because of curtailed gestation (gestational age < 37 completed weeks) are designated 'preterm'... Infants who are premature by virtue of birthweight (2500 grams or less at birth) are designated 'low birth weight' infants" (Blackmore and Rowley 1994: 179).

Preterm delivery is considered on of the predominant proximate causes of low birth weight, and together with LBW, is considered one of the leading causes of infant mortality. Yet the health conditions of LBW and preterm gestational age are not interchangeable, compared with full term LBW, preterm infants are at greater risk for morbidity, mortality and disability (Mattison et al 2001).

Gestational age at birth is now considered as a reference standard which can be used to ascertain prognosis and outcome' of preterm infants. Infants born at 32 – 36 weeks are considered 'mild prematurity' and can further be subdivided into periods of 'mild' (32 – 34 weeks) and 'moderate' (34 – 36 weeks) preterm birth. While immediate prognosis of mild preterm births is encouraging, this group contributes to high rates of infant mortality in the postnatal period (up to one year of age), particularly due to infections, asphyxia-related syndromes and SIDS (Moutquin 2003). 'Very preterm' birth is defined as birth at 28 – 31 weeks gestation, and accounts for the smallest amount of preterm births. While immediate survival is expected of very preterm infants, there are significant issues with short to long term morbidities. 'Extremely preterm' births occur at below 28 weeks gestation, and often result in early neonatal mortality, with up to 50% of severe handicaps occurring among infants born below 26 weeks gestation (Moutquin 2003; Wood 2000).

The three causes of preterm delivery are thought to be: (1) preterm spontaneous labor, (2) premature rupture of membranes (PROM), and (3) medically indicated preterm birth due to maternal or fetal indication (Moutquin 2003; Mattison et al 2001). Spontaneous preterm labor accounts for the majority of preterm births, with some researchers estimating close to 50% of preterm births are spontaneous. PROM and medically indicated preterm birth account for 25% of preterm births each (Moutquin 2003).

Preterm birthrates rose from 2002 to 2003—from 12.1 to 12. 3. This increase follows the trend that has been occurring for the past 13 years, up 16% since 1990. This increase in preterm birth is most likely the result of the growth in multiple births; multiple births are more likely to be delivered preterm (Hamilton et al 2004).

Infants born preterm have a increased chance in survival due to significant technological advances in neonatal intensive care units (NICUs). Some of the most important advances include the increased use of assisted ventilation in the delivery room and surfactant therapy (Petrou 2003). Most preterm infants born at < 32 weeks gestation will remain in the NICU until close to term in order to allow their organs to mature so that infant can survive independent of intensive care. Because of the immaturity of organ systems in preterm births, infants are at increased risk for complications (Ward and Beachy 2003). Yet while technological advances in NICU had decreased the overall cases of mortality, some researchers argue that these advances also increase long-term disability through sustaining infants who chances of survival were negligible before the development of the NICU (Doyle et al 1989; Lorenz et al 1998).

One of the major causes of morbidity and mortality among preterm infants is respiratory disease syndrome, resulting from poor lung maturation under 30 weeks gestation (Fraser et al 2004). The most frequent neurodevelopmental disability is mental retardation, followed by

cerebral palsy and blindness. A study by Lorenz et al (1998) found that 22% of infants born preterm were disabled, defined as any combination of mental retardation, cerebral palsy, blindness and deafness.

Due to the high rates complications associated with preterm births, researchers have become concerned with the economic consequences of increasing rates of preterm births. Hospitalization costs for preterm labor comprise a large portion of the maternal cost of the perinatal care in the United States, in addition to the cost in caring for preterm newborns (Nicholson et al 2000; Petrou and Davidson 2000; Phibbs et al 1981). In addition to the initial costs involved in care in the NICU, preterm infants also incur a great number of costs following their discharge from the hospital (Gennaro et al 1996; Ladden et al 1993; Petrou 2003). In addition to the financial burden on special education services, there are other long-term economic consequences including the institutionalized care for the physically and mentally handicapped, day-care services and respite care (Chaikind et al 1991; McCormick et al 1991; Petrou 2003). Multiple births are an important contributor to preterm births, particularly as women are increasingly using fertility treatments such as ovulation induction and multi-embryo transfer (Bryan 2003). These children face a higher risk of long-term disabilities, learning difficulties and language delays (Levy et al 1996; McMahon et al 1997)

Because many preterm births are the result of multiple births, researchers have begun to investigate the economic and social costs of multiple preterm births on the family (Bryan 2003). Some research has demonstrated that parents of preterm twins are less responsive to their infants those parents with singleton preterm infants (Goldberg et al 1986). Studies have documented higher rates of maternal depression following multiple preterm births, as well as a correlation with increased rates of child abuse (Cook et al 1998; Ostfeld et al 2001; Taylor et al 1988). Siblings of multiple preterm twins are more likely to have behavioral problems, often as a result of the family have to focus much more care on the preterm infants (Hay et al 1987).

Ward (2003) argues that repeated preterm labor is the related to genetic factors. This is supported by the increasing evidence that women who suffer from preterm labor often previously suffered a previous pregnancy loss or other adverse pregnancy outcomes (El-Bastawissi et al 2003; Lang et al 1996; Pickering 1991). Previous spontaneous abortions and missed abortions were associated with increased risks of preterm delivery (Buchmayer et al 2004; Carr-Hill et al 1985; Thom 1992). Researchers have also begun to investigate the role of pregnancy interval in preterm delivery. Increasing data has demonstrated that a short interval between pregnancies is an independent risk factor for recurrent preterm delivery (Fuentes-Affleck and Hessol 2000; Khoshnood et al 1998; Krymko et al 2004; Miller 1991).

In addition to genetic factors, public health advocates argue that social factors contribute to increasing rates of preterm births in the United States. While the use of race as a variable may have been previously understood as a genetic factor, increasing work on the social factors that surround various racial experiences in the United States need to be taken into account. Among non-Hispanic blacks, rates for preterm births are at 17.8 in 2003, compared to 11.3 for non-Hispanic whites, 11.9 for Hispanics and as stated above, 12.3 for all

races/ethnicities (Hamilton et al 2004). Researchers have begun to refer to this excess rate of preterm delivery among African-Americans as "the gap" (Rowley 2001).

Some view this gap as a result of socio-demographic issues such as neighborhood socio-economic status (SES) (Kaufman et al 2003; Pickett et al 2002; Picket et al 2005; Reagan and Salsberry 2005). There is evidence that neighborhood poverty rates and housing vacancy rates is a sensitive indicator across race/ethnicities. Higher neighborhood poverty and housing vacancy rates increased the rate of very preterm birth among Blacks; a higher fraction of female-headed households was correlated with increased rates of preterm deliveries among Hispanic women (Reagan and Salsberry 2005). Pickett et al (2005) demonstrate that while living in a better area reduces the risk of poor pregnancy outcomes among African-American women, living in an area in which they are a racial minority may increase the risk.

Rich-Edwards et al (2001) investigate why college-educated African-American women are more likely to deliver very low birthweight infants than college-educated white women. They argue that exposure to racism increases a woman's risk of delivering a preterm infant. In addition, there is an association between women who experience violence during pregnancy and poor birth outcomes (Fernandez 1999; Rich-Edwards et al 2001; Shumway et al 1999).

The correlation between racism and violence and preterm delivery may be the result of stressful life events and its affect on pregnancy outcomes. There is a growing literature that suggest that maternal psychological and social stress is a significant and independent risk factor for preterm birth (Hobel 2004; Lu and Chen 2004; Mancuso et al 2004; Petridou et al 2001; Pike 2005; Wadhwa et al 2001). Some researchers argue that this is an evolutionary adaptation, the result of maternal cues signaling a stressful intrauterine environment (Coall and Chisholm 2003; Pike 2005). A number of studies have demonstrated that placenta corticotrophin-releasing hormone (CRH) is sensitive to stress (Mancuso et al 2004; Petraglia 1989; Wadwha et al 1996). Stress is also related to infection in pregnancy, chronic stress and stress hormones appear to be associated with immunosuppression (Culhane et al 2001; Herrera et al 1998).

Maternal cardiovascular disorders during pregnancy, such as pregnancy-induced hypertension and pre-eclampsia are some of the major indications for medically induced preterm deliveries. There are a number of studies which have linked stress to cardiovascular disorders, although few of these studies have linked these issues during pregnancy (McCubbin et al 1996; Samadi and Mayberry 1998). In addition to the poor effects of cardiovascular disorders, gestational diabetes and pregnancy-related hyperglycemia also have negative pregnancy outcomes (Tallarigo et al 1986; Yang et al 2002). Hedderson et al (2003) found the risk of spontaneous preterm birth increased with increasing levels of pregnancy glycemia, independent of perinatal complications that could have triggered preterm delivery.

As noted above, women experiencing high levels of chronic stress are more susceptible to infections, and a number of researchers have turn their attention to the correlation between infections and preterm birth (Bergstrom 2003; Culhane et al 2001; Friese 2003; Jarjoura et al 2005; Lamont 2003; Stevens et al 2004; Yost and Cox 2000). Of increasing interest is the

association between bacterial vaginosis (BV) and preterm birth. BV is correlated with a four fold increase for risk in preterm labor through its accelerated rates of PROM and chorioamnionitis (Andrews et al 2000; Meis et al 1995; Stevens et al 2004). A number of studies have postulated that BV in early pregnancy is more of a risk for preterm labor than BV in later pregnancy (Hay et al 1994; Kurki et al 1992; Leitich et al 2003). Yet the treatment of BV early in the second trimester significantly reduces the rate of spontaneous preterm births (Hauth et al 1995; Morales et al 1994; Ugwumandu et al 2003).

BV is not the only infection of concern during pregnancy—recently periodontal infections have also been correlated with preterm birth. Periodontal disease is a chronic low-grade infection which is accompanied by inflammation and the eventual loss of tooth-supporting tissues (Jarjoura et al 2005). Analyses controlling for the effect of common demographic, socioeconomic and pregnancy-related risk factors demonstrated a significant association between periodontal infection and preterm birth, with a correlation between the severity of infection with decreasing gestational age (Jeffcoat et al 2001; Lopez et al 2002; Offenbacher et al 1996; Offenbacher et al 2001).

Infection in pregnancy can be aggravated by poor nutritional status. Women with a low prepregnancy body mass index (BMI) are at increases risk for preterm birth because of micronutrient deficiencies (Casanueva et al 1991; Neggers and Goldenberg 2003). This is an interesting finding to some scientists and nutritionists because this finding provides a relative simple intervention. Recent studies have demonstrated the use of Vitamin C in preventing PROM (Plessinger et al 2000; Romero et al 2003; Siega-Riz et al 2003) Vitamin C and E are also useful in the treatment of fetal inflammation (Romero et al 2003).

Previous Poor Pregnancy Outcome

Increasing research has begun to investigate the fact that women who have previously experienced poor pregnancy outcomes are at greater risk for repeating these occurrences. One of the most controversial aspects of this topic is the use of cesarean sections and whether subsequent births following this procedure must be another cesarean or whether women can have a vaginal birth. In 2002, 26.1% of births in the United States were delivered by cesarean, and 18% of births were primary cesareans. This is an increase from the 1989 rate of 22.8%, and 16.1% were primary. Florida rates for cesareans mirrored the national average, with 28.5% of births (Martin et al 2003). In Miami-Dade County, cesarean sections have also steadily been on the increase. In 1998, rates ranged from 23.3% to 36.7%. In 2003, rates ranged from 30.2% to 54.4%-- over twice the national average (AHCA Cesarean Rates 1998-2003). Healthy People 2010 recommends for the nationwide rate of cesareans to be at 15%.

In addition, Healthy People 2010 calls for the rate of repeat cesareans to be decreased to 63%. This rate is currently on decline in the United States—in 1989, this rate was 81.1% and in 2002, this rate was 87.4%-- although still some way to go before we reach the Healthy People 2010 goal. In Florida, 91.7% of cesareans were repeat in 2002 (Martin et al 2003). Vaginal birth after cesarean (VBAC) is a very controversial issue within the literature on cesarean sections. While some policy makers have argued that the dictum ‘once a cesarean always a cesarean’ is outdated, other argue that although women should have the choice

between a trial of labor and an elective cesarean, elective repeat cesareans are the safest decision (Sachs 2001; Sachs et al 1988; Zinberg 2001). The argument against VBAC is related to the risks involved with this procedure. There is a risk of uterine rupture with VABC and among these ruptures, the rate of fetal and/or maternal morbidity is 10-25% (Zinberg 2001:568).

There are other adverse outcomes of future pregnancies after cesarean—in some cases there is an implantation of an ectopic pregnancy in a cesarean scar. This rare occurrence is on the rise world-wide, most likely a result of the increasing number of cesarean deliveries (Maymon et al 2004).

Recent work by Sheiner et al (2004) reported that there is a significant association between repeat spontaneous abortions and subsequent pregnancy complications. In particular, complications from placental abruption, hypertensive disorders and cesarean sections were most common. Other work has demonstrated that primiparous women with a history of previous pregnancy loss have an increased risk for preterm delivery (Buchmayer et al 2004; Lang et al 1996; Pickering et al 1991). Frias et al (2004) have noted that women with a prior fetal death are at high-risk for subsequent pregnancy loss and fetal death. Their work demonstrated that fewer than 25% of pregnancies from these women resulted in a surviving infant.

Race and Ethnicity

While massive advances has been made in health care in the advent of the twentieth century, there still remains racial and ethnic disparities in reproductive health outcomes in the United States. When using race as a health indicator, it still remains a tendency for some to biologicize these differences, as if poor health outcomes was genetic predetermined. Yet it is important for researchers to acknowledge that disparities in health for ethnic minority populations are rooted in sociopolitical and economic history of the United States (*Anachebe and Sutton 2003*).

Health disparities among ethnic minorities occurs on multiple levels: differences in social, political, economic and environmental exposures that can result in differences in disease prevalence; differences in access to health care as well in the quality of health care received; experiences in bias, prejudice and stereotyping on the part of health care providers (American Public Health Association 2001; Institute of Medicine 2002).

Prenatal care provides one of the best means of monitoring maternal and fetal health during pregnancy, and perhaps preventing low birth weigh, preterm birth and other adverse pregnancy outcomes. Healthy People 2010 have advocated for at least 90% of women begin prenatal care during the first trimester. Recent data has demonstrated that 83% of women began care, yet only 78% African-American women and 74% of Hispanic women began prenatal care in the first trimester (Healthy People 2010).

With advances in Medicaid in the 1980's these disparities were supposed to decrease, yet despite promising results, lack of money or insurance was now understood not to be the only

barrier to beginning prenatal care. Other barriers commonly noted in the literature include: lack of transportation, lengthy waiting times at clinics, lack of receptive providers, and poor access to specialty care (Clark 2000; Gregory and Davidson 1994; Saha et al 1999). This was not helped in 1996 with the overhaul of the welfare-system, low-income recipients are no longer automatically eligible for Medicaid (Boonstra et al 2002).

The rates of unintended pregnancies that result in live births also vary among race/ethnicity. The rate of unintended pregnancy is higher among African-American women than white women—59.9% - 71.8% versus 31.1% - 41.7% (Henshaw 1998). This may also be related to disparities in care, because of barriers to adequate family planning services, both because of Medicaid cuts, and the cultural notions that inhibit the use of contraception in this community (Jennings 1997).

Of increasing concern in the United States in the increasing gap between African-American and white infant mortality, and some researchers have argued that 63% of this gap is the result of African American infants being born low birth weight (Collins et al 2004: 2132). This risk is not only associated with race, but often in conjunction with socioeconomic status (Kleinman and Kessel 1987) and education (Murray and Bernfield 1988). Yet increasingly research is demonstrating that the gap persists, even when controlled for maternal risk behaviors, and residence in non-impoverished neighborhoods (Berg et al 2001; Collins et al 1997; Pearl et al 2001). This has led some researchers to hypothesize that mother's experience in racism may in fact contribute to high rates of low birth weight infants among African Americans. Two recent studies have argued that the lifelong accumulated experiences of racial discrimination by African-American women constitute an independent risk factor for preterm delivery (Collins et al 2004; Mustillo et al 2004).

As researchers began to investigate rates of low birth weight infants in various communities in the United States, they made an interesting discovery. While Latina women are often considered of lower socioeconomic status than their white counterparts, they have similar rates of low birth weight births to whites. This has been entitled the "Latino Paradox," and is particularly evident among Latino mothers who are foreign-born (Fuentes-Afflick et al 1999; Scribner et al 1989; Singh and Yu 1996; Ventura et al 1985). Even after adjusting for other risk factors such as maternal behaviors, education, marital status, parity, etc... these rates do not differ between Latino women and White women (Fuentes-Afflick et al 1999). Researchers argue that more investigation is necessary to understand the favorable pregnancy outcomes of foreign-born Latina women (Fuentes-Afflick et al 1998).

Researchers have turned to maternal behaviors as a means to investigate the gap between African-American and white infant mortality. A number of studies have found that Black women are less likely to smoke than white women during pregnancy (Beck et al 2002; Ebrahim et al 2000). Other studies have shown that African-American women's reported drug use is not greater than the use patterns reported among White women (Chasnoff et al 1990; Serdula et al 1991; Singh and Yu 1995). In fact, African-American women who did not smoke during pregnancy still had higher rates of infant mortality than white women who did (Matthews et al 2002).

Because traditional SES positive attributes do not function as a protective factor against infant deaths among African-Americans, it is important to investigate the literature on racism and poor birth outcomes. Some researchers argue that exposure to racism overrides the protective factor of maternal SES—while living in a better area reduces the risk of poor pregnancy outcomes among African-American women, living in an area in which they are a racial minority may increase this risk (Pickett et al 2005).

Acknowledging that the gap in infant mortality rates is not simply due to maternal SES factors, and that maternal experiences with racism seem to have an effect on low birth weight and preterm births, two of the major factors contributing to infant mortality, researchers have begun to postulate that birth outcomes are the consequences of experiences over the life course of women. This perspective calls for research that moves beyond comparing risk factors during pregnancy to understanding the cumulative effects of a life experiences on women's and infant's health. This method pays particular attention to racism, stress and behavioral factors as they occur across a woman's lifetime, recognizing that short-term behavioral modifications during pregnancy may not be enough to prevent infant death and other poor pregnancy outcomes (Lu and Halfon 2003).

Differences in preterm birth rates have led researchers to explore the disparities that exist among race/ethnicities in the United States. Among non-Hispanic blacks, rates for preterm births are at 17.8 in 2003, compared to 11.3 for non-Hispanic whites, 11.9 for Hispanics and as stated above, 12.3 for all races/ethnicities (Hamilton et al 2004). Researchers have begun to refer to this excess rate of preterm delivery among African-Americans as "the gap" (Rowley 2001).

Some view this gap as a result of socio-demographic issues such as neighborhood socio-economic status (SES) (Kaufman et al 2003; Pickett et al 2002; Picket et al 2005; Reagan and Salsberry 2005). There is evidence that neighborhood poverty rates and housing vacancy rates is a sensitive indicator across race/ethnicities. Higher neighborhood poverty and housing vacancy rates increased the rate of very preterm birth among Blacks; a higher fraction of female-headed households was correlated with increased rates of preterm deliveries among Hispanic women (Reagan and Salsberry 2005). Pickett et al (2005) demonstrate that while living in a better area reduces the risk of poor pregnancy outcomes among African-American women, living in an area in which they are a racial minority may increase the risk.

Rich-Edwards et al (2001) investigate why college-educated African-American women are more likely to deliver very low birthweight infants than college-educated white women. They argue that exposure to racism increases a woman's risk of delivering a preterm infant. In addition, there is an association between women who experience violence during pregnancy and poor birth outcomes (Fernandez 1999; Rich-Edwards et al 2001; Shumway et al 1999).

Smoking

Smoking during pregnancy can have adverse outcomes for maternal and fetal (as well as subsequent infant) health. Healthy People 2010 have targeted an increase in cessation to 30%

of pregnant smokers during the first trimester and abstinence from cigarettes by 99% of women giving birth (US DHHS 2000). Nationwide, smoking rates have indeed decreased from the period of 1990-2002. Smoking has decreased 38%; in 1990, 18.4% of women reported smoking to 2002, when 11.4% of women reported smoking during pregnancy (MMWR 2004: 911). Among females aged 15-19 years, maternal smoking has fluctuated during this time period. Each year from 1996 – 2001, this age group has the highest percentage of smoking during pregnancy than any other age group. Yet in 2002, rate of maternal smoking among teens (16.7%) was similar to that for women aged 20-24 years, with the highest percentage among women aged 18-19 years (18.2%) (MMWR 2004: 912). In Florida, smoking rates have mirrored decrease that has been seen in the national trend: in 1990, 18.3% of women smoked during pregnancy and in 2002, 8.6% of women were maternal smokers—this is a reduction of 53%. Among teens aged 15-19 years in Florida, 16.4% of these girls were maternal smokers in 1990 and in 2002, 11.2% of them smoked during pregnancy, a reduction in 32% (MMWR 2004: 913-914).

Prevalence for maternal smoking were higher among women who were younger, white, had less education and lower incomes, and were either on Medicaid or had no insurance (Lipscomb et al 2000; Martin et al 2001; MMWR 2004). Recent work analyzed the costs of smoking related admissions to neonatal intensive care units (NICU), which in 1996 were $366 million in the United States or $704 per maternal smoker MMWR 2004: 915). Smoking during pregnancy has long-term effects as well. Some studies have shown that there are small differences in the height and head circumference in children at age 7 and decreased height up to age 23. Children of smokers tend to be shorter and have higher weight for their height than children on non-smokers (Cornelius and Day 2000).

The recognition that smoking adversely affects pregnancy was first reported in 1957, and has been linked to a number of adverse outcomes, including low birth weight, preterm birth, premature rupture of the membranes, placenta previa, abruption placenta, perinatal mortality, and sudden infant death syndrome (Blair et al 1996; Hadley et al 1990; Meyer and Tonascia 1976; Pollack et al 2000; Salihu et al 2003; Tuthill et al 1999). Smoking has been particularly linked to low birth weight, it has been demonstrated that there is a positive association between smoking and fetal growth restriction. Secker-Walker and Vacek (2003) demonstrated that birthweight increased as maternal weight gain increased, but smoking decreased net maternal weight gain—therefore restricting fetal growth.

Smoking has been strongly associated with fetal and infant mortality (Malloy et al 1988; Salihu et al 2003; Tuthill et al 1999). Salihu et al (2003) found a significant relationship between the reported number of cigarettes smoked per day during pregnancy and the subsequence likelihood of infant death before its first birthday. They found that for every 10 cigarettes smoked per day during pregnancy, there was a 4% rise in the hazard of infant death. Researchers think that low birth weight and preterm birth are most likely the two factors responsible for this causal link between maternal smoking and infant death (Mainous et al 1994). One recent study found that within their study population, low birth weight was the dominant and almost exclusive mechanism through which maternal smoking caused infant mortality (Salihu et al 2003).

Increasing research has also begun to explore the link between maternal smoking and sudden infant death syndrome (SIDS). Chong et al (2004) has argued that once other risk factors (multiple births; preterm births; births to single mothers; births to mothers of low maternal age and infants slow to gain weight) are controlled for, one of the key risk factors for death from SIDS is maternal smoking. The data is supported by other research which has demonstrated that infants of smoking mothers are less arousable (Chang et al 2003; Franco et al 1999; Lewis et al 1995).

Stress

An increasing number of researchers are arguing that maternal psychological and social stress is a significant factor for poor pregnancy outcomes. Stress has been related to many disease processes including cardiovascular disease, autoimmune disease and dermatologic disease (Nelson et al 2003). Many of the communities who experience adverse pregnancy outcomes also experience chronic stress, leading researchers to begin to investigate the correlation between these two factors.

Stress as a risk factor has proved particular useful in researching race as a variable in poor pregnancy outcomes. Much of the literature argues that racial/ethnic disparities in birth outcomes can be explained by maternal age, education, lifestyle and socioeconomic status. Yet these factors only explain a small amount of variation in racial/disparities (Livingston et al 2003). For instance, college-educated African-American women are more likely to deliver a very low birth weight infant than their non-Hispanic white counterparts (Kleinman et al 1987).

Recent studies have demonstrated that there is a correlation between stress and early pregnancy loss. Neugeberger et al (1996) demonstrated that women who reported at least one negative life event in the five months preceding the loss had a two-fold increased risk for a chromosomally normal spontaneous abortion and this factor remained constant even after controlling for smoking, caffeine and alcohol consumption.

There is a growing literature that suggests that maternal psychological and social stress is a significant and independent risk factor for preterm birth (Hobel 2004; Lu and Chen 2004; Mancuso et al 2004; Petridou et al 2001; Pike 2005; Wadhwa et al 2001). Some researchers argue that this is an evolutionary adaptation, the result of maternal cues signaling a stressful intrauterine environment (Coall and Chisholm 2003; Pike 2005). A number of studies have demonstrated that placenta corticotrophin-releasing hormone (CRH) is sensitive to stress (Mancuso et al 2004; Petraglia 1989; Wadwha et al 1996).

Stress is also related to infection in pregnancy, chronic stress and stress hormones appear to be associated with immunosuppression (Culhane et al 2001; Herrera et al 1998). Women experiencing high levels of chronic stress are more susceptible to infections, and a number of researchers have turn their attention to the correlation between infections and preterm birth (Bergstrom 2003; Friese 2003; Jarjoura et al 2005; Lamont 2003; Stevens et al 2004; Yost and Cox 2000). Culhane et al (2001) demonstrated that high levels of chronic stress during

pregnancy are associated with bacterial vaginosis, and this association remains strong even after controlling for sociodemographic and behavioral risk factors.

Substance Abuse

In addition the dangers in smoking during pregnancy, researchers have also argued that other substances can be detrimental to maternal and fetal health. Research in this area is difficult because women who are substance abusers typically also use cigarettes, as well as have other risk factors which endanger the health of the fetus. Yet increasing research has begun to try and tease out the effects of substance abuse on fetal health, as well as the long term health of the infant.

The CDC (MMWR 2004) has surveyed women of childbearing age (18-44) about their drinking habits with the concern that women may be binge-drinking (five or more drinks on one occaision) and may be pregnant without knowing it—therefore exposing their fetus to alcohol. The results of this analysis indicated that the prevalence of alcohol use among women who may become pregnant is similar to that of women of childbearing age overall. Women who might become pregnant were defined as those who were not using birth control, and also stated one of the following reasons: wanted a pregnancy, did not care if a pregnancy occurs or did not think they would become pregnant (MMWR 2004: 1178). Women who might become pregnant reported binge drinking at a prevalence of 12.4%, similar to the reported prevalence for all respondents (MMWR 2004:1180). Women in Florida reported a prevalence of 9.8% – 12.3% for binge drinking among women of childbearing age (MMWR 2004: 1181).

It has been estimated that close to 20% of women consume alcohol during pregnancy (MMWR 1997). Excessive drinking during pregnancy has been associated with Fetal Alcohol Syndrome (FAS) which is characterized by growth retardation, low birth weight, small head circumference, decreased length, facial dysmorphism and central nervous system dysfunction (Huestis et al 2002; Johnson and Leff 1999). In addition to FAS, there is also a syndrome named Fetal Alcohol Effects (FAE) which is named for its lesser degree of alcohol exposure and toxicity (Finnegan et al 1997). It is difficult for researchers to agree at what level alcohol is danger during pregnancy. Some argue that greater than 3 oz daily is problematic, yet it recommended that no alcohol consumption is safe (Holtzman et al 1995). O'Callaghan et al (2003) found that moderate drinking during pregnancy did not have any long term affects from birth through 5 years on growth or head circumference. Moderate drinking is defined as less than 2 drinks per day or from one-half to one drink per day. Their work is consistent with other several previous studies showing no long term effects from moderate drinking during pregnancy (Jacobson et al 1994; Sampson et al 1994).

Another issue in substance abuse during pregnancy is the use of cocaine and its effect on fetal health, as well as the long term affect on the infant. Infants exposed to cocaine in utero are at-risk for low birth weight, smaller head circumference and decrease in birth length (Bada et al 2002; Coles et al 1992). In term or near-term infants, cocaine use has been reported to shift birth weight and head circumference into the lower percentiles. Because the

fetus rapidly grows after 30 weeks of gestation, any use of cocaine later in pregnancy can have negative effects on fetal growth.

Cocaine use is particularly problematic when used in conjunction with other harmful substances—including tobacco or alcohol. Synergistic interactions have been found by a number of researchers, such as cocaine/alcohol's affect on birth weight and head circumference (Coles et al 1992; Singer et al 1994). More recent work has argued that there is also a relationship between maternal psychological distress, substance abuse and poor fetal outcome (Singer et al 2002).

Unintended Pregnancy

Researching unintended pregnancy is a complex issue, and often involves people's moral feelings about life, contraception, abortion, children and parenting. This issue has particular interest for those who are interested in women's access and utilization of family planning, as well as for those who are committed to women receiving adequate prenatal care. Recent data suggests that over 40% of all pregnancies in the United States are unintended (Henshaw 1998). Unintended pregnancy is considered costly both financially and socially—in terms of medical costs, the costs of caring for more children, and the inability of women to attain personal/professional goals (Lee and Stewart 1995).

An unintended pregnancy is either 'mistimed,' that is, the woman wanted to be pregnant later or 'unwanted,' in that the woman did not want to ever be pregnant. Much of the research on unintended pregnancy has been based in the National Surveys of Family Growth (NSFG) which were completed in 1973, 1976, 1982, 1988, 1995 and 2001. Women are surveyed with the following question: "Did you become pregnant sooner than you wanted, later than you wanted or at about the right time?" (Campbell and Mosher 2000). More recently, the CDC developed the "Pregnancy Risk Assessment Monitoring System" or PRAMS which is an on-going, state-specific, population-based surveillance system of maternal behaviors and experiences before, during and after pregnancy. PRAMS is currently collected in 31 states and 1 city, and collects data on 60% of U.S. births and has supplemented vital statistics data since 1987 (PRAMS Fact Sheet
http://www.cdc.gov/reproductivehealth/PRAMS/pramsFS_unitendpreg.htm).

For those women having a live birth in Florida in 1999, 31.6% claimed this pregnancy was mistimed and 10.9% claimed it was unwanted. The PRAMS data for 1999 shows that unintended pregnancy was most common among women who were young, African-American, women who had less than 12 years of education and women whose prenatal care was paid for by Medicaid (PRAMS Fact Sheet). Other risks included higher parity, single status, childhood abuse or household dysfunction (Dietz et al 1999; Green et al 2002) Most likely these findings reflect differences in education, socioeconomic status, cultural factors and access to family planning and health care services among communities of women in these states (MMWR 1999).

Recent work has begun to explore how pregnancy intendedness relates to maternal behaviors during pregnancy. Many researchers have noted that it is particularly difficult to pin down

women's attitudes toward intention in pregnancy; in many cases a woman's feelings about a current pregnancy may change as a pregnancy progresses (Rosenzweig and Wolpin 1993; Stanford et al 2000). In some cases, the partner's attitude about a pregnancy may influence a woman's ideas about her own pregnancy status (Campbell and Mosher 2000). In any case, women's attitudes about her pregnancy can influence particular behaviors during pregnancy, in particular—the use of prenatal care, smoking and adoption of breastfeeding (Joyce et al 2000). Many studies have found that unstable pregnancy intention may be an indicator of adverse maternal behaviors related to infant health (Kost et al 1998; Marsiglio and Mott 1988; Weller et al 1987). Other adverse maternal behaviors related to unintended pregnancy include alcohol consumption and drug use (Green et al 2002).