

# Healthy & Intended Pregnancy

IN BOULDER COUNTY

*Assessment of data, experience,  
and effective strategies*

**July 2014**



**BOULDER COUNTY  
PUBLIC HEALTH**

*Opportunity for a healthy life.*

# Healthy & Intended Pregnancy IN BOULDER COUNTY

*Assessment of data, experience, and effective strategies.*

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# Executive Summary

In his introduction to the Boulder County Public Health Strategic Plan 2013-2018, Executive Director Jeff Zayach states, “Through this strategic plan, Boulder County Public Health is charting a course to ensure that our work is most effective in improving the health of all people in our community.” Specifically, the plan directs our agency to engage in thorough population health assessment and planning activities to prioritize health issues and determine the Boulder County Public Health (BCPH) role in addressing these issues. In short, we want to use community data, published literature, and the experience of staff to ensure that we are doing the “right work” in the “best way.”

A cross-divisional Strategic Plan Implementation Team selected healthy and intended pregnancy (HIP) as the first focus for assessment, based on criteria that includes availability of data, agency readiness, and interest across divisions. They also recognized that the process developed for the HIP assessment—and lessons learned—could inform future assessments of other health issues identified in the BCPH strategic plan.

The primary purpose of this report is to present the BCPH Management Team with recommendations for the configuration of public health strategies that have the greatest potential to positively impact healthy and intended pregnancy in our county. The report also summarizes the community-level data, literature, and staff experience related to healthy and intended pregnancy that are the foundation for the recommendations, and describes the assessment process and staff participation in the process.

## Process and Participation

### Team composition and recruitment

The BCPH Family Health and Community Health division managers identified a staff member from their divisions to serve as co-leads for the HIP assessment process. These division managers also participated as advisors/observers throughout the process. A technical team was convened to assemble and interpret population data for the assessment and participated as full team members. The co-leads, advisors, and technical staff formed the HIP Planning Team, which met between full HIP Team meetings to identify steps in the process, troubleshoot process issues, and develop meeting agendas.

The remaining HIP Team members were recruited via a BCPH all-staff email that outlined the expected commitment for team participation and requested a statement of interest from persons volunteering for the team. The co-leads reviewed the nominations and selected team members who represented a range of BCPH divisions, subject matter expertise, and skill sets.

### Timeline

The HIP assessment was scheduled to begin in mid-September 2013 and was expected to take approximately three months, with weekly team meetings and homework assignments taking place between meetings. The launch of the assessment was delayed until mid-October due to staff responsibilities during the Boulder County flood emergency. As this first BCPH assessment process unfolded, it became clear that the original timeline was underestimated. The HIP Team continued meeting nearly every week through May 2014. The assessment report and recommendations were completed for presentation to the BCPH Management Team in June 2014.

## Team Members

### Co-Leads

- Jane McKinley\* | Nurse-Family Partnership Program Coordinator
- Jody Scanlon\* | GENESIS/GENESISTER Program Manager

### Facilitator/Coordinator

- Nancy Johnson\* | Communication and Health Planning Administrative Specialist

### Subject Matter Experts

- Maya Dansie | GENESISTER Youth Specialist
- Patty Garcia | GENESIS Parent Educator
- Chana Goussetis | Marketing and Communications Manager
- Laura Hochman | GENESIS Supervisor
- Shann Holt | WIC Supervisor
- Sarah Scully | Child Health Promotion Program Coordinator

### Technical Team

- Bernadette Albanese\* | Director of Health Services
- Lucy Alderton\* | Communicable Disease Epidemiologist
- Namino Glantz\* | Health Planner

### Process Observers/Advisors

- Heather Matthews\* | Family Health Division Manager
- Andrea Poniers\* | Community Health Division Manager

\*Members of the HIP Planning Team

## Process

The BCPH strategic plan describes an iterative assessment process to improve health outcomes that includes the following steps: 1) gather and review data; 2) identify influencing factors; 3) identify effective practices; and 4) use defined criteria to select interventions that strengthen systems, promote healthy policy and environments, and assure linkage to services. Criteria for selecting interventions were developed by the BCPH Management Team and include magnitude and severity of the health problem, impact on equity, effectiveness of interventions, community readiness, and agency readiness. The population health assessment process was explained in detail in a “How-To” document that became the roadmap for the HIP assessment. The HIP Planning Team modified the process in response to new information, insights, or issues that emerged as the HIP Team proceeded through the steps.

Initial HIP Team meetings focused on establishing ground rules and setting team expectations for homework, electronic document storage, decision-making, and other matters. The team then worked together to create a system map as a means of organizing its approach to the issue and identifying the wide range of factors that influence healthy and intended pregnancy. This led to the decision to explore pregnancy intention and healthy pregnancy as separate concepts. The team also agreed on common definitions of each term:

### Intended:

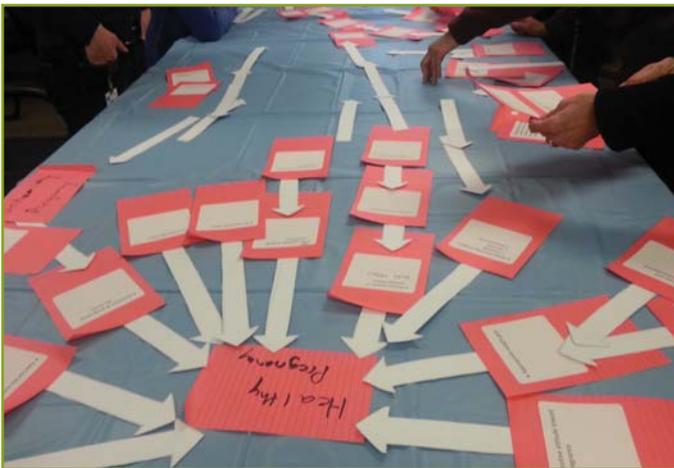
A pregnancy that, at the time of conception, was planned and/or wanted, and the timing was chosen by the parent(s).

### Healthy:

A pregnancy that lasts 39-40 weeks gestation, results in a healthy baby at a healthy weight with no complications, and in which the mother is well the whole 9 months other than normal discomforts such as morning sickness.

Compiling and interpreting quantitative data on pregnancy and women of childbearing age in Boulder County and Colorado was an ongoing activity throughout the assessment process. As the Technical Team completed work with each data source, they presented the information for discussion at full HIP Team meetings, including integrating the data with literature and staff experience. The discussion often suggested additional data requests for the Technical Team to pursue.

Meanwhile, the full HIP Team engaged in reading published literature on unintended pregnancy, especially noting information on magnitude and severity of the identified problems and related health disparities. Detailed notes were compiled in a shared spreadsheet for reference throughout the process. Each team member summarized readings for the



SYSTEM MAPPING



full team, which discussed the information and compared it with staff experience in Boulder County. They then returned to the system map and made revisions based upon what they had learned. Pregnancy prevention was highlighted as critical during this phase of the process.

Next, the team followed a similar process of literature review, reporting out, and discussion on healthy pregnancy. A key issue the team grappled with was whether a healthy pregnancy and delivery were the only desired outcomes to be considered for this assessment, since it is known that lifelong health status is heavily dependent on the nature of early childhood experiences. Current BCPH programming is built on the assumption that pregnancy and childhood outcomes are related. After much discussion, the team decided that positive early childhood development was relevant to this assessment as a desired outcome of healthy and intended pregnancy, and as a key part of the life course model that served as a framework for the assessment. The team reviewed literature on the relationship between early childhood trauma and health outcomes, especially as they related to healthy and intended pregnancy. However, the team recognized that scope of the HIP assessment ended at birth outcomes, and early childhood warranted its own full assessment.

In continuing to refine the system map, the HIP Team determined that a tool was needed besides the system map to clearly organize and display the wealth of information gathered during the assessment. The final revision, which was labeled a “conceptual framework,” uses a modified life course model as a way of organizing protective and risk factors for healthy and intended pregnancy that were gleaned from the literature, community-level data, and staff experience in each phase.

Using the decision-making criteria of magnitude, severity, and health disparities, the team pulled key findings and target populations from the information included in the conceptual framework and ensured that the findings were consistent with program experience in Boulder County. The key findings were then prioritized by mapping them onto a diagram of quadrants representing high and low magnitude and severity and noting the degree of impact each factor had on health disparities. (Figure 1) Through this process of problem assessment, the

team selected two primary areas of intervention for healthy and intended pregnancy: 1) unintended pregnancy and contraceptive use, and 2) poor mental health, including pregnancy-related depression.

For strategy assessment, sub-groups researched evidence-based and promising strategies in the two selected areas of intervention and presented this information to the team for discussion. As a final step in the process, the full HIP Team refined the list of recommended strategies and integrated them into a logic model that would be presented to BCPH Management Team and is included in this assessment report. (Figure 2)

## Prioritized Problems and Populations Related to Healthy and Intended Pregnancy

The HIP Assessment Team reviewed key findings from community-level data, published literature, and staff experience (summarized later in this report) to identify areas in which public health efforts could most effectively impact healthy and intended pregnancy in Boulder County. The areas of greatest potential impact were: alcohol use; contraceptive use; maternal body mass index (BMI)/weight; mental health, including pregnancy-related depression; prenatal care and services; smoking; and unintended pregnancy. The team then placed each of these possible areas of intervention on a matrix, according to magnitude and severity of related health problems, and rated the degree of health disparities for each (high, medium, low). Figure 1 illustrates the team’s prioritization of the problem areas using these criteria.

Through this process, the HIP Team prioritized two **key issues to be addressed** in the area of healthy and intended pregnancy in Boulder County:

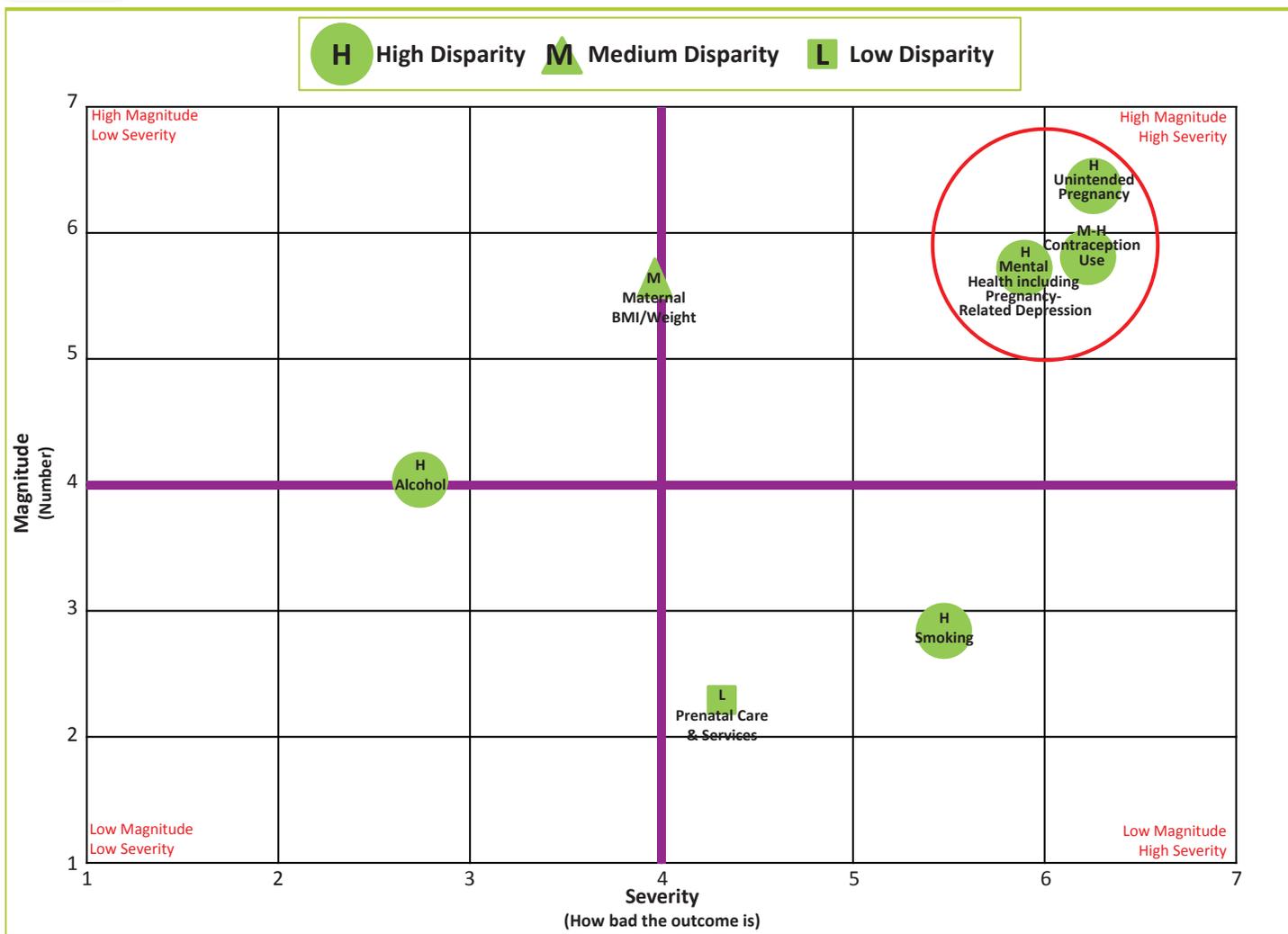
- **Unintended pregnancy and contraceptive use**
- **Poor mental health, including pregnancy-related depression.** (Factors related to poor mental health include: sadness; hopelessness; stress; violence; partner/marital conflict, separation, or divorce; and substance abuse problems within the home.)

The team identified women ages 15-24 as the **priority population** for BCPH intervention. Although the number of births to women in this age range is less than in other age groups, the likelihood of poor health outcomes related to pregnancy is greater for younger women. The team acknowledged health disparities with Hispanic women and women of low income across all age ranges. While strategies can be directed at the target group, population-based interventions have the potential to impact pregnancy intendedness and healthy outcomes among all women of child-bearing age in Boulder County.

## Recommendations for Effectively Addressing Healthy and Intended Pregnancy

The logic model (Figure 2) lists effective strategies for addressing the prioritized problems of unintended pregnancy and contraceptive use and poor mental health. The strategies address individual, relationship, community, and societal contexts, creating a comprehensive approach to promoting healthy and intended pregnancy. Just as we could not identify a single influencing factor for healthy and intended pregnancy, we also cannot expect to create meaningful change on this health issue through any single strategy. The logic model demonstrates how the strategies lead to achieving long-term public health goals of intended, appropriately timed, and wanted pregnancies; healthy pregnancies; healthy newborns; and healthy early childhood development. The listed strategies form

**FIGURE 1**



recommendations to BCPH Management Team to guide agency and, potentially, community programming and interventions in this important area of public health. Although the HIP Assessment Team determined that early childhood development warranted a separate focused assessment, a recommendation related to this phase of life was included in this assessment because it is inextricably linked to both the prevention of mental health concerns and to positive pregnancy outcomes.

## Summary of Key Learnings from Community-Level Data, Literature, and Experience that Informed Decisions and Recommendations

The following sections summarize the community-level data, published literature, and experience of BCPH subject matter experts that were reviewed during the HIP assessment process, and led to the problem areas prioritized by the HIP Team. The information is organized according to stages of the life course related to healthy and intended pregnancy: pregnancy intention and contraception; preconception; prenatal; perinatal and newborn; and early childhood. It is set within the context of Boulder County demographics and fertility rates. Findings on mental health are also included in each section.

The data, literature, and staff experience confirm that the social determinants of health heavily influence health behaviors and health outcomes at every stage of the life course. These include economic status, race/ethnicity, education, age, parents' level of education, culture, belief systems, housing, food security, documentation status, location of residence, environmental toxicants, acculturation, family support, violence, mental wellness, social connectedness, and more.

In the sections below, *white* refers to *white, non-Hispanic* and *Hispanic* refers to *white, Hispanic*. Further detail of the assessment in each area is included in the *Community-Level Data and Literature* section of this report, beginning on page 13.

## Demographics and Fertility

In Boulder County in 2012, approximately 66,000 women were of childbearing age (i.e. ages 15-44), with about 29,000 people being in the priority population of women ages 15-24. In that same year, there were 3,044 live births in Boulder County, for a fertility rate of 45.8 births per 1,000 female population, which was lower than the state rate of 62.0 per 1,000 female

population. The number and percentage of births was highest among women ages 30-34 and among white women (as compared to Hispanic). Fertility rates peaked at a younger age in the county's Hispanic population (25-29 years) than in the white population (30-34 years). In general, Hispanic mothers were more likely than white mothers to have less than a high school education, be unmarried, have annual incomes below \$25,000, and have Medicaid payment for delivery.

## Pregnancy Intention and Contraception

### Outcomes

For purposes of the HIP assessment, an intended pregnancy was defined as a pregnancy that, at the time of conception, was planned and/or wanted, and the timing was chosen by the parent(s). Unintended pregnancies, in contrast, are defined as being mistimed and/or unwanted at the time of conception. Unintended pregnancies are associated with many negative health outcomes for mother and child, including poor maternal mental health, inadequate/delayed prenatal care, premature birth, low birth weight, low rates of breastfeeding, reduced quality of the mother-child relationship, and less than optimal child development. However, negative child outcomes are not related to unintendedness when socioeconomic status was controlled for, which reinforces the influence of social determinants of health. The social, health, and economic costs of unintended pregnancy impact individuals as well as society as a whole.

*“In my experience, early intervention can break the cycle, allowing children a brighter outcome...”*

— PATTY GARCIA

GENESIS parent educator

## Protective factors

*Protective factors are those conditions and behaviors that support positive health outcomes.*

Protective factors promoting intended pregnancy include: education, especially the opportunity for higher education; being informed, able to self-advocate, and empowered to make positive decisions about reproductive health; and having access to and effectively using birth control. Another protective factor is positive influence of the woman's sexual partner that results in pregnancy that is consensual, planned, spaced, and timed well for both the mother and the father, with minimal ambivalence. Family size and birth order are also key considerations.

## Risk factors

Risk factors for unintended pregnancy include being less than 24 years old, Hispanic, unmarried, cohabiting, and having lower income, less than high school education, no religious or faith-based affiliation, and already had a child. Lesbian/gay/bisexual/transgender/queer/questioning (LGBTQQ) youth are also at higher risk. Unintended pregnancy rates tend to be higher among those with less knowledge about the potential for pregnancy and about reproductive health, in general. Lack of access to services, including birth control, as well as cultural stigma surrounding contraception and abortion are also associated with unintended pregnancy. At times, the intention to avoid pregnancy is foiled by incorrect or inconsistent use of birth control, stemming from a variety of factors.

Subject matter experts recognize these and other reasons for not practicing contraception, such as denial of pregnancy risk, low self-esteem, a controlling or abusive relationship, non-consensual intercourse and/or conception, real or perceived side effects of contraception, negative attitudes toward contraception, perceived low social support from partners and peers, low self-efficacy, substance abuse, poor communication skills, inadequate community resources, religion, cost, lack of future orientation and sense of hope, and poor mental health. Subject matter experts point out that teens, in particular, may reside in neighborhoods with poor supervision and also may experience fear of telling their parents about sexual activity. Adolescent social and cognitive development further complicates a teen's ability to anticipate the need for contraception and follow-through with contraception protocols. These suggest the critical need for consistent, ongoing, influential relationships to produce behavior change that stems unintended pregnancy, which is supported by published

literature. In addition, experts are aware that health care providers sometimes have negative views of teen contraceptive use and may be conservative in using long-acting reversible contraceptives (LARCs) due to cost. Clients may personally experience racism in seeking health care that inhibits their use of these resources.

BCPH subject matter experts speak to the pervasive impact of social determinants, cultural context, and world view around pregnancy as contributing to unintended pregnancy. They point out the power of intergenerational patterns and culture, in which there is often discomfort with sex and childbearing, social acceptance of teen pregnancy, and lack Snapshot of Boulder County.

## Snapshot of Boulder County

In Boulder County from 2002 to 2011, 71.6% of pregnancies were categorized as intended and 28.4% as unintended. This compares favorably to the national average of 51% of pregnancies being unintended between 2001 and 2008. In terms of intendedness in partners, 6.6% of Boulder County women reported that their husbands or partners said they did not want them to be pregnant.

Pregnancy intendedness is correlated with age in Boulder County, as 60.9% of teens ages 15-19 years reported that their pregnancies were unintended, compared to 45.3% of mothers ages 20-24 years and 26.6% of those ages 24-35 years. Hispanic women may have a higher proportion of pregnancies that were reported as unintended (34.8%), as compared to white

**“Subsequent pregnancy prevention is critical in limiting long-term poor outcomes.”**

—JODY SCANLON

GENESIS and GENESISTER program manager

FIGURE 2

# Creating a Community in Which All Pregnancies are Intended and Healthy



women (26.3%). More than 4 in 10 women who were not trying to get pregnant were not doing anything to prevent pregnancy. Among those women not trying to get pregnant and not using methods to prevent pregnancy, nearly half (47.4%) stated they did not mind getting pregnant, conveying an attitude of ambivalence. Other reasons for not using contraception among this group of women included inconsistent use, difficulty in obtaining, and unwillingness to use contraceptives due to lack of access (7.3%), opposition by husband or partner (13.8%), and side effects (9.8%). BCPH subject matter experts suggest that the data underestimate ambivalence, especially in teens.

## Preconception Health

### Outcomes

Mothers' health, pregnancy outcomes, and infant health begin before conception. It is important for women to be healthy and adopt healthy behaviors well before pregnancy since most women are not aware of their pregnancies until several weeks after conception and because health behaviors established prior to pregnancy may persist postpartum. Encouraging protective behaviors and controlling or preventing health problems and risk behaviors before pregnancy can improve the health of the woman and increase the likelihood of a good pregnancy outcome. Women whose pregnancies are intended generally are more attentive to preconception health, which also impacts maternal and child health outcomes. BCPH subject matter experts note that preconception health is not relevant concept for all cultures.

### Protective factors

Protective factors for preconception health include reproductive health components, such as fertility, contraception if desired, and absence of sexually transmitted infections. Access to health services, including screening for risk behaviors and health conditions, related counseling and intervention, as well as oral health care, are key protective factors. Protective factors also include absence of pre-existing medical conditions, use of multivitamins, folic acid intake, healthy maternal weight, mental wellness (including absence of physical abuse by the husband/partner during the 12 months before pregnancy), and absence of substance abuse.

### Risk factors

Risk factors for women during the preconception period that are related to poor pregnancy outcomes include medical

conditions like diabetes and hypertension, previous preterm birth, unhealthy weight, poor nutrition, lack of physical activity, frequent alcohol consumption, smoking cigarettes, and experiencing multiple stressors before pregnancy. These stressors can be linked to depression and previous depressive episodes as well as physical abuse prior to pregnancy, which is associated with late prenatal care, especially among older women of higher socioeconomic status. The populations at risk for each of these conditions, behaviors, or life events vary by age, race, and ethnicity, among other factors. However, key social determinants of health—particularly poverty and low education—are disproportionately related to many of these risk factors.

### Snapshot of Boulder County

In 2010-2012 in Boulder County, the rates of both pre-pregnancy diabetes and pre-pregnancy hypertension were less than 1%. Just 1.5% of women had a previous preterm birth, which is another risk factor. In terms of maternal weight, 62% of all births were characterized by normal maternal pre-pregnancy BMI, while 20% were overweight, and 13% were obese. There are racial/ethnic disparities in pre-pregnancy BMI. Rates of overweight and obesity were higher in the Hispanic population (28% and 23%, respectively) than in the white population (18% and 10%, respectively). In the 3 months prior to pregnancy, 13.7% of Boulder County women smoked cigarettes. Nearly 2 out of 3 (63.2%) of women had experienced 1 or more stressful life events in the 12 months before delivery.

## Prenatal Health

### Outcomes

The prenatal period extends from conception to birth. Prenatal health care and mothers' healthy behaviors lead to improved birth outcomes, including healthy birth weight. Regular medical checkups during pregnancy increase the chances of early identification of problems that may be managed or prevented.

### Protective factors

Protective factors during the prenatal period include smoking cessation, abstinence from alcohol and other drugs, and early prenatal care, as well as oral health, appropriate nutrition, folic acid intake, adequate and appropriate physical activity, social support, and prenatal education.

### **Risk factors**

Risk factors during the prenatal period include tobacco use, alcohol and illicit drug use, poor maternal nutrition, inadequate or excessive weight gain, delayed entry into prenatal care, and poor mental health due to stress and physical abuse. BCPH subject matter experts add that factors contributing to delayed prenatal care include denial of the pregnancy, fear of others finding out about the pregnancy, lack of access to services, fear of interacting with systems due to documentation status, personally experienced racism in health care, unintended pregnancy, and cost. Nationally, prenatal health tends to be poorer among mothers who are lower income, lower education, never married, teenagers, have an unwanted or mistimed pregnancy, or who use Medicaid for prenatal care. BCPH subject matter experts note that pressures of daily living and maternal depression negatively influence a woman's ability to practice self-care during pregnancy. Poor health behaviors, learned intergenerationally, can negatively impact pregnancy outcomes.

### **Snapshot of Boulder County**

As a whole, between 2010-2012, women in Boulder County had low rates of tobacco use, alcohol consumption, and serious health conditions (e.g. diabetes and hypertension) and high rates of accessing prenatal care. An exception was excessive weight gain in 45% of pregnant women, and mental health stressors in 63% of pregnant women. There were several

*“Problems often seem to be very multifaceted, likely impacted by preconception issues with mom, prenatal conditions for the developing fetus, and exposure/environment after birth. The combination of these influences creates ‘the perfect storm’ for short- and long-term negative health outcomes.”*

—SHANN HOLT

WIC registered dietitian

disparities by age, race/ethnicity, and income, with the burden of poor prenatal health often falling on Hispanics, 20-24 year-old mothers, and mothers with lower income. Hispanic women were more likely to begin prenatal care after the first trimester (20%) than white women (11%). Exceptions among this pattern of disparities included tobacco use and excessive weight gain, which were higher in whites, and alcohol, which was higher in women over age 35 years.

## **Perinatal And Newborn Health**

### **Outcomes**

While definitions vary, the perinatal period begins about the 20th week of pregnancy and extends to about 28 days after birth. This period can include health complications for both the mother and the newborn. Low and very low birth weight and preterm birth are among the more common conditions that lead to poor infant outcomes during the perinatal period. Maternal mental health, including pregnancy-related depression, is an often-overlooked but serious perinatal health outcome that has implications for both the mother and newborn. Some perinatal complications are preventable through changes in health behaviors and regular prenatal care to detect potential problems.

### **Protective factors**

Protective factors for positive perinatal and newborn outcomes include term pregnancy, appropriate pregnancy weight gain, appropriate birth weight of the infant, and breastfeeding. Breastfeeding requires family, peer, and provider support. Maternal health education, such as around oral health, can also positively impact infant and child health.

### **Risk factors**

Hispanic women, teen women (especially Hispanic teens), women who underwent in vitro fertilization, women with multiple births (twins, triplets, etc.), and women with low income are among the demographic groups at risk for poor perinatal and newborn outcomes. Women with low income are more likely to have less access to health services than women with more financial resources. Length of maternity leave affects maternal mental health as well as child development, and women with low income are more likely to have no maternity leave. Looking at health behaviors related to perinatal and newborn outcomes, not breastfeeding is associated with postnatal maternal complications and poorer newborn outcomes, which may lead to heightened health risk during

childhood, such as for obesity. Lower breastfeeding rates tend to be more common among women with unintended pregnancies and postpartum maternal employment. Mothers who smoke have increased risk of having infants with Sudden Infant Death Syndrome (SIDS) and respiratory tract infections. Smoking during pregnancy is more likely among women with low income and low education levels.

Women whose pregnancies are unintended are less likely to use maternal and child health services that can detect health complications during the perinatal period. Mothers who suffer from depression are also more likely to have worse outcomes; pregnancy-related depression can negatively impact bonding and child development. Physical abuse is a risk factor for low birth weight and morbidity and mortality in both mother and infant, in part because domestic violence destabilizes the ability of parents to meet infant needs. Substance abuse undermines healthy coping with the stress of a newborn. Subject matter experts underscore that social isolation compounds difficulties of pregnancy and parenting, and cultural isolation impacts a family's ability to follow traditional practices that foster health and recovery. Further, experts point out that poverty can decrease both parents' sense of self-efficacy adequately caring for a newborn.

### Snapshot of Boulder County

Of the 3,044 births in Boulder County in 2012, 15.6% were preterm, 8.5% were low birth weight (<2,500 grams) and 1.2% (just 36 of 3,044 births) were very low birth weight (<1,500 grams). The highest number and percentage of low birth weight and preterm births occurred among mothers ages 30 years and older because most births in Boulder County are to that age group. Further, white mothers accounted for the highest number of low birth weight, very low birth weight, and preterm births; however, proportionately, the percentage of births that were low birth weight or preterm births were similarly distributed among whites and Hispanics.

In 2012, the neonatal mortality rate was 2.6 deaths per 1,000 live births, or just 8 of the 3,044 live births. Among the 8,978 live births in Boulder County between 2010 and 2012, 7,504 (83.6%) had no abnormal conditions. Of all live births in those 3 years, 9.3% were admitted to the neonatal intensive care unit. In Boulder County, mothers of 88.7% of the 8,978 live births between 2010 and 2012 reported no maternal morbidity during pregnancy.

Among infants born in Boulder County in 2012, 94.6% were reported to have been breastfeeding at discharge from the hospital. Not all of these mothers continued to breastfeed for the recommended duration of 6 months: 16.3% reported breastfeeding for 4 weeks or less; 5.1% reported duration of 5-8 weeks, and 78.6% breastfed for 9 or more weeks. While most mothers in Boulder County are physically healthy, postpartum depression is a common challenge.

According to data collected in 1997-1999 and 2000-2003 from women who had given birth, about half (51.6%) were not depressed at all in the months after delivery, while 34.1% were a little depressed, 10.8% were moderately depressed, 3.1% were very depressed, and .3% were very depressed and had to get help. In 2009-2010, 67.7% of recent mothers in Boulder County reported that a health care provider talked with them about what to do if they felt depressed during pregnancy or after delivery.

## Early Childhood Development

By definition, healthy and intended pregnancy does not seem to include the early childhood period. During the assessment process, however, published literature and BCPH subject matter experts continually emphasized that the early childhood phase of the life course was inextricably linked to healthy and intended pregnancy in two ways:

### ● Pregnancy outcomes.

In establishing desired outcomes for healthy pregnancy, birth outcomes such as birth weight, term delivery, maternal health, etc., were important but insufficient to completely convey the impact of healthy and intended pregnancy. The HIP Team agreed that early childhood development outcomes (including social and emotional development) are equally as important as birth outcomes in informing our strategies.

### ● Prevention and mental health.

The literature on mental wellness of women of reproductive age focused more on treatment rather than prevention or early intervention. The preponderance of evidence pointed to the effectiveness of early childhood interventions to prevent mental health concerns. The overwhelming message was that promoting health during early childhood is more effective and less costly than waiting to address mental health until later in life through treatment.

# Community-Level Data and Literature

## Primary Sources of Data Regarding Pregnancy in Boulder County

The two primary sources of data on pregnancy, as well as pregnancy and neonatal outcomes, in Colorado are the Colorado Certificate of Live Birth and the Pregnancy Risk Assessment Monitoring System (PRAMS). Both systems are maintained by the Colorado Department of Public Health and Environment (CDPHE). Data from these sources are available at the county level, which can be compared to recognized state or national benchmarks and health outcome objectives. Two of the benchmark sources used in this assessment were Healthy People 2020<sup>1</sup> and Women's Health USA 2011.<sup>2</sup> Both birth certificate and PRAMS datasets can be stratified by subgroups of women. Such analyses helped reveal health disparities based on age, race/ethnicity, education, and household income, featured in the pages that follow. Data from these sources were complemented and contextualized by knowledge gained via literature review and the experience of subject matter experts.

### Birth Certificate Data

This dataset contains information on maternal and paternal characteristics and health outcomes of live births in Colorado. Information on births is collected from the Colorado Certificate of Live Birth, a document completed by one or both parents and the health care provider at the time of birth. At the county level, birth certificate data represent a full census of births to mothers who report being residents of Boulder County. In Boulder County in 2012, there were 3,044 live births; for the period 2010 through 2012, there were of 8,978 live births. The Colorado Certificate of Live Birth collects an array of information, including parental demographics, pregnancy risk factors or complications, maternal health behaviors, labor and delivery characteristics, and neonatal complications.

### PRAMS Data

The Pregnancy Risk Assessment Monitoring System (PRAMS) collects state-specific, population-based data on maternal

attitudes and experiences prior to, during, and immediately following pregnancy. PRAMS data in Colorado are available beginning from 1997. Unlike birth certificate data, PRAMS is a sample survey of a subset of women who had a live birth within the previous three months; data are then statistically weighted to be representative of the overall population of women giving birth in Colorado. The survey is administered by mail or telephone, and the average survey response rate is about 70%. Due to the relatively low number of PRAMS surveys completed each year, the statistics in this report refer to multiple years of data that are combined to form more stable estimates for county-level estimates. PRAMS collects information regarding maternal demographics, pregnancy intention, prenatal care and obstetric history, maternal stressors and substance abuse, pregnancy complications, infant health care, and injury prevention.

Detailed information regarding the use of birth data or PRAMS is available at:

[www.cohid.dphe.state.co.us/birthdata.html](http://www.cohid.dphe.state.co.us/birthdata.html)  
[www.chd.dphe.state.co.us/cohid/topics.aspx?q=Pregnancy\\_Risk\\_Assessment\\_Data](http://www.chd.dphe.state.co.us/cohid/topics.aspx?q=Pregnancy_Risk_Assessment_Data)

## Fertility Rates and Maternal Characteristics of Live Births

To understand and impact healthy and intended pregnancy in Boulder County, we studied the demographic characteristics of the female childbearing population in our community, as well as indicators of social determinants that influence pregnancy and families.

In 2012 in Boulder County, there were 3,044 live births among the 66,500 total females aged 15-44 years (i.e. considered to be of reproductive age), yielding a fertility rate of 45.8 births per 1,000 female population.<sup>3</sup> Demographic characteristics of live births varies, as noted in Table 1 below. Note this table summarizes three years of birth data for Boulder County. In this report, 'white' refers to white, non-Hispanic, and 'Hispanic' refers to white, Hispanic.

**Table 1.  
Demographics of Live Births  
Boulder County, 2010-2012**

Category/Level	# of live births to all races/ethnicities	Live births to white mothers		Live births to Hispanic mothers	
		#	%*	#	%*
Total live births	8,978	6,001		1,881	
Mother's education					
Less than high school graduation	1,172	182	3.1%	845	45.9%
High school graduate or GED	1,116	522	8.8%	468	25.4%
Some college, no degree	1,131	762	12.8%	251	13.6%
College graduate or advanced degree	5,377	4,492	75.4%	276	15.0%
Father's education					
Less than high school graduation	1,153	176	3.1%	852	51.7%
High school graduate or GED	1,172	635	11.2%	416	25.2%
Some college, no degree	938	728	12.8%	124	7.5%
College graduate or advanced degree	5,025	4,154	73.0%	257	15.6%
Marital status					
Married	7,251	5,083	84.9%	1,256	66.9%
Never married	1,521	790	13.2%	569	30.3%
Divorced or married but separated	182	115	1.9%	53	2.8%
Household income					
Less than \$24,999	2,221	860	15.9%	1,076	68.8%
\$25,000-49,999	1,146	750	13.8%	266	17.0%
\$50,000-74,999	1,055	879	16.2%	77	4.9%
More than \$75,000	3,443	2,935	54.1%	145	9.3%
WIC**					
Mom got WIC food during pregnancy	2,290	732	12.5%	1,255	70.4%
Source of payment for delivery					
Private insurance	5,937	4,765	79.7%	470	25.4%
Medicaid	2,321	835	14.0%	1,165	63.1%
Self-pay	385	270	4.5%	82	4.4%
Other governmental source	265	111	1.9%	130	7.0%

Source: Boulder County Birth Certificate Dataset, 2010-2012, CDPHE.

\*Percentage is of all live births in the racial/ethnic category.

\*\*The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

**Geography:** In 2012, the general fertility rate among women aged 15 to 44 years was lower in Boulder County (45.8/1,000 female population), as compared to the Colorado average (62.0/1,000).<sup>4</sup>

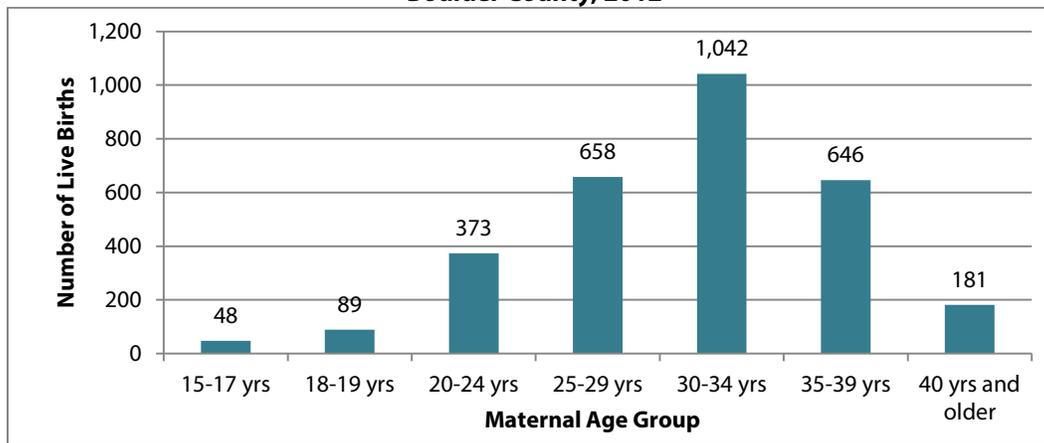
**Age:** In Boulder County in 2012, the number of live births, percentage of all live births, and fertility rate were highest among women aged 30 to 34 years, as displayed in Figure 1.<sup>5</sup>

**Race/ethnicity:** Figure 2 and Table 2 demonstrate that the highest number and percentage of live births in Boulder County in 2012 were to white, non-Hispanic mothers, as compared to Hispanic or any other racial or ethnic group.<sup>6</sup>

In 2012, for Hispanics, the proportion of births and fertility rates peaked at a younger age (25 to 29 years) than what was observed among whites (30 to 34 years), as shown in Table 2 and Figure 3.<sup>7</sup>

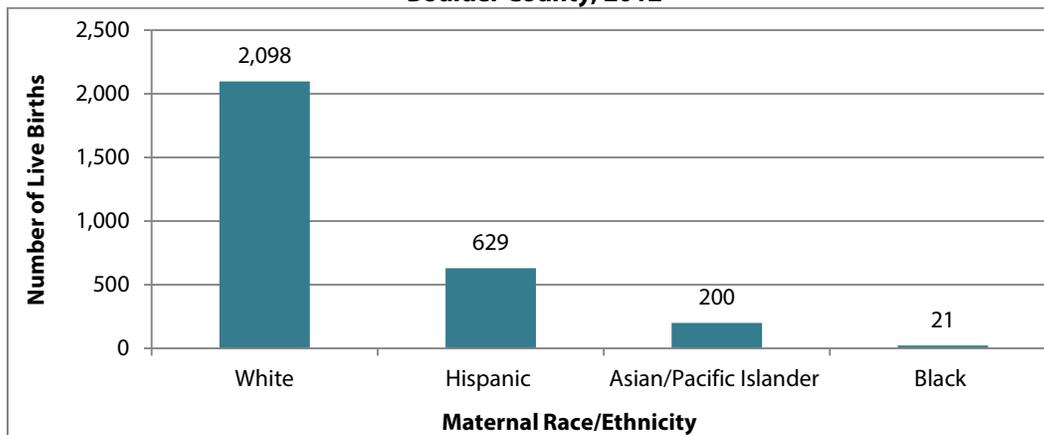
In 2012, fertility rates were substantially lower among white women aged 25 to 29 years in Boulder County when compared to the Colorado average (58.9 versus 93.0 per 1,000 females, respectively).<sup>8</sup> Differences were also noted among Boulder County Hispanic women, who had a higher rate for women aged 25 to 29 years (119.5) and a lower rate for women aged 20 to 24 years (91.1). However, in Colorado, the peak fertility rate was noted among Hispanic women aged 20 to 24 years (113.4).<sup>9</sup>

**Figure 1.**  
**Number of Live Births by Maternal Age Group**  
**Boulder County, 2012**



Source: Boulder County Birth Certificate Dataset, 2012, CDPHE.

**Figure 2.**  
**Number of Live Births by Maternal Race/Ethnicity**  
**Boulder County, 2012**



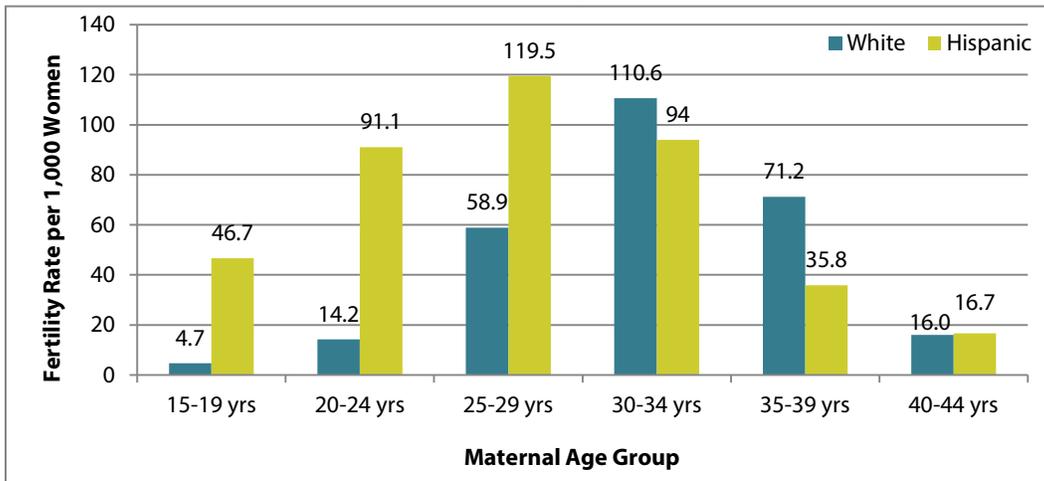
Source: Boulder County Birth Certificate Dataset, 2012, CDPHE.

**Table 2.**  
**Live Births by Maternal Age Group and Race/Ethnicity**  
**Boulder County, 2012**

Maternal age group	Live births to white mothers		Live births to Hispanic mothers	
	#	%	#	%
15 to 19 yrs	43	2%	86	14%
20 to 24 yrs	176	8%	161	26%
25 to 29 yrs	409	19%	168	27%
30 to 34 yrs	800	38%	139	22%
35 to 39 yrs	518	25%	53	8%
40 to 44 yrs	136	6%	20	3%

Source: Boulder County Birth Certificate Dataset, 2012, CDPHE.

**Figure 3.**  
**Fertility Rate\* by Maternal Age Group and Race/Ethnicity**  
**Boulder County, 2012**



Source: Boulder County Birth Certificate Dataset 2012, CDPHE.

\*The general fertility rate is the total number of births per 1,000 females among women of childbearing age, defined as ages 15-44 years. An age-specific fertility rate is the number of births for a specified age group per 1,000 females in the age group.

**Parity:** In Boulder County, 45% of babies born in 2012 were first children.<sup>10</sup> However, that figure varied greatly by maternal age group; 89% of births among women aged 15 to 19 years were first live birth, as compared to 43% of births to women 30 to 34 years of age.<sup>11</sup>

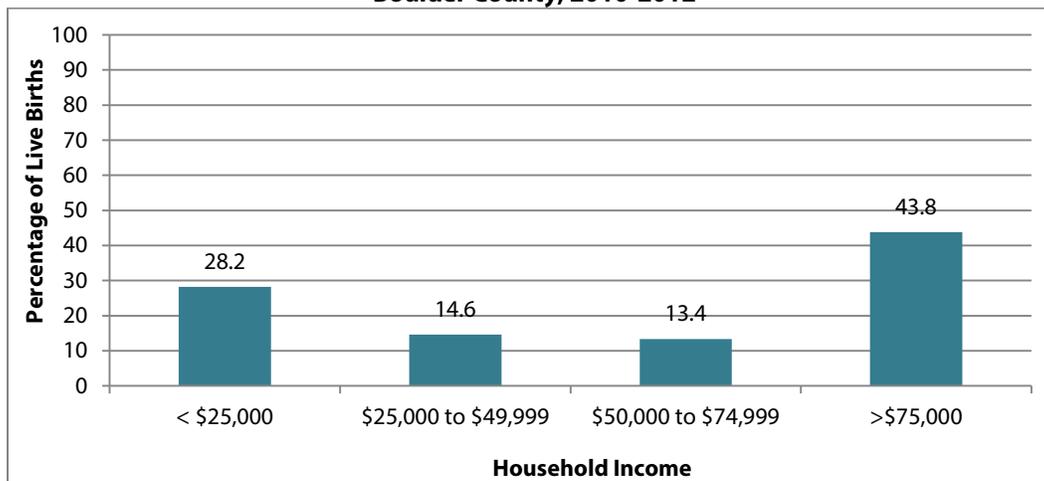
**Education:** Nearly two-thirds of all live births in Boulder County between 2010 and 2012 occurred to mothers with 16 or more years of education.<sup>12</sup> The percentage of live births that represented the mother's first child was the lowest among mothers with 0-11 years of education (23.9%) and highest for mothers with 16 or more years of education (48.0%).<sup>13</sup> Additionally, between 2010 and 2012, the proportion of Hispanic mothers with less than a high school education (45.9%) was 15 times higher than white mothers (3.1%) in Boulder County.<sup>14</sup> Fathers' education mapped similarly onto race/ethnicity.<sup>15</sup>

**Marital status:** In all, 80.3% of women who gave birth between 2010 and 2012 in Boulder County were married; 2.0% were separated or divorced; and 16.9% had never married. The highest number of births to unmarried women occurred among the 20-24 year age group and among white women.<sup>16</sup> Three out of 10 Hispanic births were to mothers who were unmarried, as compared to 13.2% of white women.<sup>17</sup>

**Income:** Between 2010 and 2012, 44% of Boulder County births occurred in households with an annual income of \$75,000 or more; 28% of births occurred in households with income below \$25,000, as shown in Figure 4.<sup>18</sup> Racial and ethnic differences were striking, as 68.8% of Hispanic births were to families with household income under \$25,000, while 54.1% of white births were in households with income over \$75,000.<sup>19</sup>

**Access to services:** Eighty-five percent of women who gave birth in Boulder County between 2010 and 2012 entered prenatal care in their first trimester, while 14% got care after the first trimester, and less than 1% did not receive prenatal care.<sup>20</sup> Source of payment for delivery was most often private insurance (66.6%), followed by Medicaid (26.0%), self-pay (4.3%), and other governmental source (3.0%).<sup>21</sup> In all, 73.5% of births were to women not participating in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) at the time of birth.<sup>22</sup> The percentage of Hispanic women participating in WIC (70.4%) was much higher than the percentage of white women in WIC (12.5%), indicating significant differences in the need for supplemental nutrition among Hispanic mothers.<sup>23</sup>

**Figure 4.**  
**Live Births by Household Income**  
**Boulder County, 2010-2012**



Source: Boulder County Birth Certificate Dataset, 2010-2012, CDPHE.

# Pregnancy Intention and Contraception

While pregnancy intendedness may be expressed in the literature in a variety of ways, for the purposes of this HIP assessment, an intended pregnancy was defined as, “a pregnancy that, at the time of conception, was planned and/or wanted, and the timing was chosen by parent(s).” Unintended pregnancy, in contrast, was defined as, “a pregnancy that is mistimed and/or unwanted at the time of conception.”

Unintended pregnancies are associated with many negative health outcomes for mother and child, including poor maternal mental health and behavior, inadequate/delayed prenatal care, premature birth, low birth weight, decreased breastfeeding, reduced mother-child relationship quality, poor child developmental outcomes,<sup>24</sup> and maternal depression.<sup>25</sup> For instance, low birth weight was 1.2 to 1.4 times more likely to occur with unintended pregnancy.<sup>26</sup> Pregnancies that were unwanted rather than mistimed tended to have poorer outcomes.<sup>27</sup> While adverse outcomes of unintended pregnancy vary from one socio-demographic population to another, the social, health, and economic costs of unintended pregnancy impact individuals, as well as society as a whole.<sup>28</sup> For instance, unintended pregnancy increases societal costs, making prevention of unintended pregnancy a cost-effective investment. In fact, in 2010 alone, Colorado taxpayers saved \$46,364,700 in averted teen births.<sup>29</sup>

Literature reviewed and subject matter expertise indicates that generally, rates of unintended pregnancy were highest among women who are: unmarried; cohabitating (vs. married), especially if under 25 or low income; lesbian, gay, bisexual, transsexual, queer (LGBTQ) youth; teens; over age 40; less educated (i.e. without a high school diploma); black or Hispanic; low income (i.e. at or near poverty line); having one child; and/or having no religious affiliation.<sup>30</sup> Unintended pregnancy rates tended to be higher among those with less knowledge about the risk of pregnancy and about reproductive health, in general. Lack of access to services, including birth control, as well as cultural stigma surrounding contraception and abortion, were also associated with unintended pregnancy.<sup>31</sup> At times the intention to avoid pregnancy was foiled by incorrect or inconsistent use of birth control, stemming from a variety of factors.<sup>32</sup> Lower socioeconomic status was associated with unintended pregnancy and was also an independent factor impacting maternal and child outcomes. For instance, higher rates of unprotected sex and contraceptive failure were found in lower socioeconomic status groups. Poor child outcomes were not

related to unintendedness when socioeconomic status was controlled for.<sup>33</sup>

Subject matter experts emphasized protective factors promoting intended pregnancy, including absence of risk factors, such as reproductive health and general education, especially the opportunity for higher education; being informed, able to self-advocate, and empowered to make positive decisions; and having access to and effectively using birth control. Other protective factors were positive paternal influence that resulted in pregnancy that was consensual, planned, spaced, and timed well for both the mother and the father, leading to minimal ambivalence. Family size and birth order were also key considerations.

Unintended pregnancies can be averted with proper use of effective contraception. Racial and ethnic differences in contraceptive use, as well as method choice and contraceptive effectiveness, may contribute to disparities in unintended pregnancy.<sup>34</sup>

Due to surveillance issues specifically related to underreporting of pregnancies ending in abortion, it is difficult to firmly calculate unintended pregnancy rates.<sup>35</sup> While abortion was not a focus of this assessment, connections between intendedness and abortion were revealed. For example, unintended pregnancies were more likely to end in abortion among women who are black; unmarried; with lower family size; some college but no degree; higher income; no religious affiliation; and exposure to adverse experiences, such as abuse, neglect, and household dysfunction.<sup>36</sup> The literature and subject matter experts also recognized lower health risks among women undergoing an abortion procedure than risks associated with childbirth.<sup>37</sup>

## Pregnancy Intention

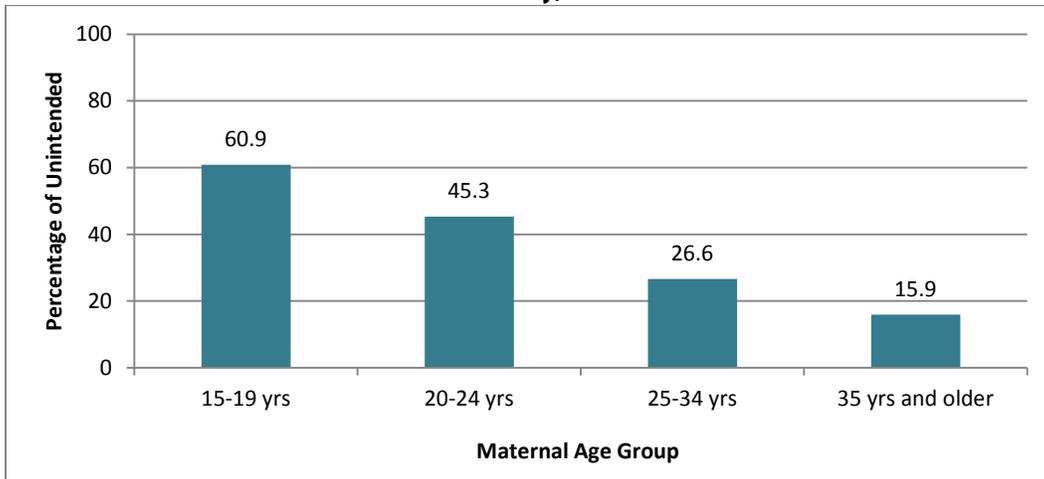
In Boulder County from 2002 to 2011, 71.6% of pregnancies were categorized as intended and 28.4% as unintended.<sup>38</sup> This compared favorably to the national average of 51% of pregnancies being unintended between 2001 and 2008.<sup>39</sup> Among Boulder County women who had recently given birth, when asked to think back to just before they got pregnant, about half of women (52.4%) wanted the pregnancy at that time, while 19.2% wanted it sooner, 23.4% wanted it later, and 5.0% never wanted the pregnancy.<sup>40</sup> These survey responses were used by the data source to categorize pregnancies as intended or unintended, with unintended defined as, “Not wanting to be pregnant at all or wanting to be pregnant at a later time.”<sup>41</sup> In terms of how intendedness was viewed by partners, 6.6% of Boulder County women said that their husband/partner said he did not want her to be pregnant.<sup>42</sup>

In Boulder County, pregnancy intendedness was highly correlated with age. As shown in Figure 5, from 2002 to 2011, 60.9% of teens aged 15-19 years reported that their pregnancies were unintended, as compared to 45.3% of mothers aged 20-24 years and 26.6% of those aged 25-34 years.<sup>43</sup>

Similarly, nearly one-third of teen mothers aged 15-19 years (32.3%) also reported that their husband/partner also did not

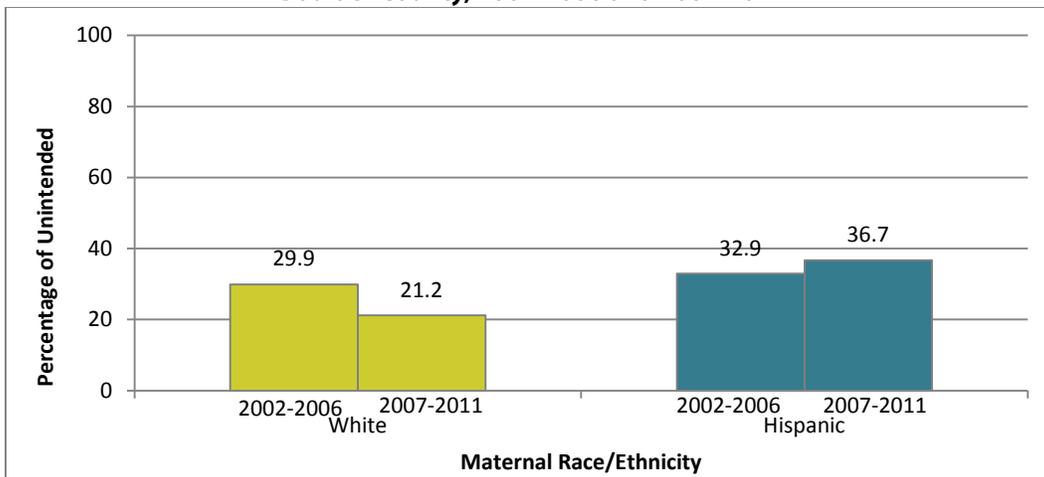
want the pregnancy, while rates were well less than half that for women 20 years and older.<sup>44</sup> While racial/ethnic and time period differences are not statistically significant, Figure 6 suggests that Hispanics may have a higher proportion of pregnancies reported to be unintended (34.8%) as compared to whites (26.3%), and that the proportion of unintended pregnancies may be shifting over time.<sup>45</sup>

**Figure 5.**  
**Unintended Pregnancies\* by Maternal Age Group**  
**Boulder County, 2002-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.  
\*As reported by mother.

**Figure 6.**  
**Unintended Pregnancies\* by Maternal Race/Ethnicity**  
**Boulder County, 2002-2006 and 2007-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.  
\*As reported by mother.

## Contraception

While 71.6% of Boulder County pregnancies in 2002-2011 were intended, overall 35.7% of women were not trying to get pregnant at the time of conception.<sup>46</sup> In other words, many women who were not trying to get pregnant reported their pregnancies to be intended. Specifically among women who stated they were *not* trying to get pregnant, only 58.2% were using some method to prevent pregnancy, while 41.8% were not using any method to keep from getting pregnant.<sup>47</sup> That meant over 4 in 10 women who were not trying to get pregnant were not doing anything to prevent pregnancy. Subject matter experts were acutely aware of this gap between women not aiming to get pregnant yet not practicing contraception to prevent pregnancy.

In 2002-2011, among those women who were not trying to get pregnant *and* were also not using any methods to prevent pregnancy, nearly half (47.4%) stated they did not mind getting pregnant, conveying an attitude of ambivalence.<sup>48</sup> Subject matter experts suggested that the data underestimate ambivalence, especially in teens. Other reasons for not using contraception among this group of women who were not trying to get pregnant and not using contraception included inconsistent use of, difficulty in obtaining, and unwillingness to use contraceptives for a number of reasons. Speaking to lack of awareness, 23.4% of these women did not think they could get pregnant at the time of conception (despite not using contraception), and 5.4% thought their husband/partner or themselves were sterile (i.e. unable to get pregnant).<sup>49</sup> Interestingly, only 7.3% had trouble getting birth control when they needed it.<sup>50</sup> In terms of self-efficacy, 13.8% stated that their husband/partner did not want to use any method to keep from getting pregnant.<sup>51</sup> Others (9.8%) reported having side effects from birth control.<sup>52</sup>

Subject matter experts recognized these same reasons for not practicing contraception, such as denial of pregnancy risk, controlling or abusive relationship, real or perceived side effects of contraception, or difficulty obtaining contraception. Additionally, they called attention to negative attitudes toward contraception, perceived low social support from partners and peers, low self-efficacy, poor communication skills, inadequate community resources, religion, and cost. For teens in particular, subject matter experts noted that teens may reside in neighborhoods with poor supervision and may fear telling their parents about sexual activity.

Subject matter experts also called attention to a number of socioeconomic factors that impacted both intendedness and use of contraceptives. Teens with lower education attainment, higher use of publically funded services, and living in poverty

were especially likely to have unintended pregnancies and lower use of contraceptives. Documentation status was another demographic factor, with unintended pregnancy and low contraceptive use being more common among undocumented women. Experts were very aware of challenges related to health care access and service providers' perspectives. Specifically mentioned were contrasting philosophy on teen contraceptive use, Title X clinics' more limited use of long-acting reversible contraception (LARC) due to cost, and racism personally experienced by women in health care that inhibited their use of these community resources.

Subject matter experts underscored a number of individual behavioral factors that they associated with unintended pregnancy and low use of contraceptives, including lack of self-efficacy and low self-esteem, non-consensual intercourse and/or conception, unhealthy relationships, domestic violence, substance abuse, and poor mental health. These suggest the critical need for consistent, ongoing, influential, and positive relationships to produce behavior change underlying to reduce unintended pregnancy.

Beyond individual behavior, experts often spoke to the pervasive impact of social determinants, cultural context, and world view around pregnancy. They pointed out the power of intergenerational patterns and culture, in which there was often cultural discomfort with sex and childbearing, social acceptance of pregnancy in high-risk populations, and lack of life opportunities for young women. These social determinants might trump intendedness in influencing outcomes. In this context, it is not surprising that some individuals were at higher risk, such as girls in foster care and in the juvenile justice system and children and siblings of teen parents. Based on this data, we began to understand why some individuals have not only one unintended pregnancy but repeat unintended pregnancies.

## Preconception Health

Maternal health, pregnancy outcomes, and infant health begin before conception, be it a first or subsequent pregnancy. It is important for women to be healthy and to adopt healthy behaviors well before pregnancy because most women are not aware of their pregnancies until several weeks after conception,<sup>53</sup> and because health behaviors established prior to pregnancy may persist postpartum.<sup>54</sup> Further, preconception health is related to pregnancy intendedness, an independent factor impacting maternal and child health outcomes.<sup>55</sup> That said, BCPH subject matter experts note that preconception health is not a relevant concept for all cultures.

Encouraging protective behaviors and controlling or preventing health problems and risk behavior before pregnancy can improve the health of the woman and increase the likelihood of a good pregnancy outcome.<sup>56</sup> Protective preconception factors include fertility (see Intention and Contraception section), contraception (see Intention and Contraception section), and absence of sexually transmitted infections. Access to health services (including screening for risk behaviors and health conditions, related counseling and intervention, and oral health care) was a key protective factor. Protective factors also included absence of pre-existing medical conditions, healthy maternal weight, mental health, and absence of substance abuse.<sup>57</sup>

Subject matter experts recognized the need to impact maternal obesity rates and healthy eating habits. These experts pointed to research indicating that preconception maternal BMI (body mass index) may be equally or more important than prenatal weight gain in determining healthy weight and body fat of the developing baby in utero and at birth, and can also affect the child's long-term weight status and health, even into the teen and adult years. Interventions prior to conception, although often difficult, may be the most effective in impacting long-term health, both of the mother and her children, and possibly their children in the future.

## Pre-pregnancy Conditions

Pre-pregnancy conditions can have a significant impact on maternal and infant health. In Boulder County from 2010 through 2012, the rates of both pre-pregnancy diabetes and pre-pregnancy hypertension were very low, at less than 1%.<sup>58</sup> The Boulder County rates of both pre-pregnancy diabetes and pre-pregnancy hypertension met the Women's Health USA 2011 goals. Additionally, just 1.5% of women had a previous preterm birth, another risk factor.<sup>59</sup>

## Maternal Weight

Prior to pregnancy, women should attain a healthy weight, have good nutrition, and exercise adequately. Being

overweight or obese pre-pregnancy can be predictive of higher infant birth weight and fetal growth.<sup>60</sup> In Boulder County, 62% of all births from 2010 through 2012 were characterized by normal maternal pre-pregnancy BMI, while 20% of mothers were overweight, and 13% were obese; this compares favorably to 2012 Colorado rates.<sup>61</sup> The Boulder County rate of normal maternal pre-pregnancy BMI also exceeded the Healthy People 2020 goal. There were racial/ethnic disparities in pre-pregnancy BMI. While 68% of whites had normal BMI, only 46% of Hispanics had normal BMI. Rates of mothers being overweight and obese were higher in the Hispanic population (28% and 23%, respectively) than in the white population (18% and 10%, respectively), as noted in Table 3.<sup>62</sup>

## Cigarette Smoking

Cigarette smoking increases the risk of pregnancy complications, preterm birth, and low birth weight.<sup>63</sup> In Boulder County from 2002 through 2011, during the three months prior to pregnancy, 13.7% of women smoked cigarettes.<sup>64</sup> Figure 7 illustrates that the percentage of mothers who smoked cigarettes in the 3 months prior to pregnancy was highest among 15-19 year-old women (34.7%) and was progressively lower among older women (8.1% of women aged 35 years and older).<sup>65</sup>

## Mental Health

Experiencing multiple psychosocial stressors before pregnancy can increase the likelihood of poor pregnancy outcomes. In Boulder County in 2002 through 2011, 63.2% of women had experienced 1 or more stressful life events (such as inability to pay bills, getting separated or divorced, lost a job, homelessness) in the 12 months before delivery; 19.4% had experienced 3 or more.<sup>66</sup> (See Prenatal section for a discussion of stressors in the 12 months prior to delivery, which includes 3 months preconception). These stressors can be linked to depression and previous depressive episodes,<sup>67</sup> as well as physical abuse prior to pregnancy, which, for instance, was associated with late prenatal care, especially among older women of higher socioeconomic status.<sup>68</sup>

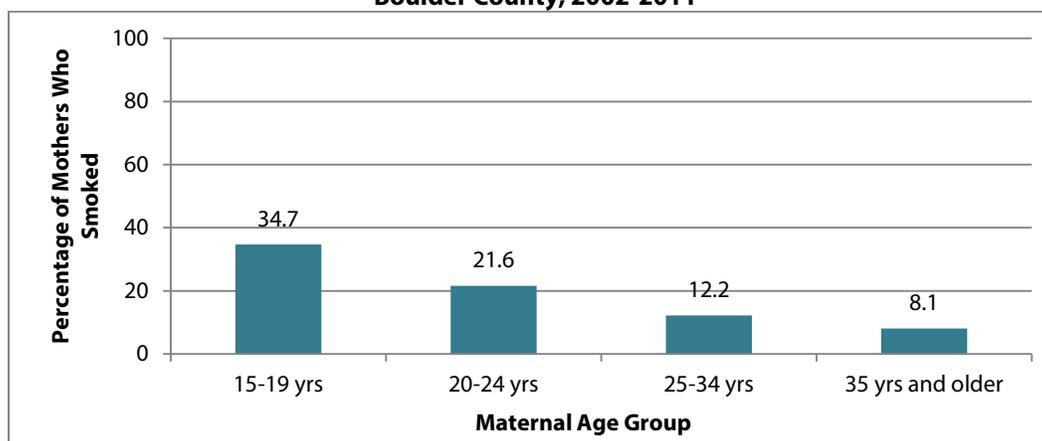
**Table 3.**  
**Maternal Pre-pregnancy BMI by Race/Ethnicity**  
**Boulder County, 2010-2012**

	All Races/Ethnicities		White		Hispanic	
	#	%	#	%*	#	%*
Underweight	407	5%	268	5%	59	3%
Normal weight	5,432	63%	3,971	68%	818	46%
Overweight	1,767	20%	1,063	18%	492	28%
Obese	1,087	13%	565	10%	406	23%

Source: Boulder County Birth Certificate Dataset, 2010-2012, CDPHE.

\*Percentage is among all live births in racial or ethnic category.

**Figure 7.**  
**Maternal Cigarette Smoking in 3 Months Prior**  
**to Pregnancy by Maternal Age Group**  
**Boulder County, 2002-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.

## Prenatal Health

The prenatal period extends from conception to birth. Prenatal health care and the mother's healthy behaviors lead to improved birth outcomes, including healthy birth weight. Regular medical checkups during pregnancy increase the chances of early identification of problems with the pregnancy that may be managed or prevented.

Risk factors during the prenatal period include tobacco use, alcohol consumption, poor maternal nutrition, inadequate or excessive weight gain, delayed entry into prenatal care, and poor mental health due to stress and physical abuse. Conversely, protective factors during the prenatal period include smoking cessation, abstinence from alcohol, and earlier prenatal care,<sup>69</sup> as well as oral health, appropriate nutrition, adequate and appropriate physical activity, and prenatal education. The National Survey of Family Growth indicated

that nationally, prenatal health tended to be poorer among mothers who were lower income, lower education, never-married, teens, had an unwanted or mistimed pregnancy, and who used Medicaid for prenatal care.<sup>70</sup>

## Cigarette Smoking

Tobacco use during pregnancy has an adverse impact on both mother and baby. Smoking during pregnancy increases the risk of prematurity, placenta previa, abruption placentae, low birth weight, intrauterine growth retardation, and infant mortality.<sup>71</sup>

While 13.7% of women smoked in the 3 months before they got pregnant (2002-2011),<sup>72</sup> less than 4% of mothers in Boulder County reported smoking at all during pregnancy (2010-2012).<sup>73</sup> The low rate of smoking in Boulder County during the third trimester (3.4%) from 2010 through 2012 was more favorable than the 2012 Colorado rate and easily eclipsed the

Women’s Health USA 2011 goal.<sup>74</sup> However, although 96.1% of women did not smoke during pregnancy,<sup>75</sup> Boulder County had not yet achieved the Healthy People 2020 goal,<sup>76</sup> and inequities exist. Any smoking during pregnancy was higher in white women (4.8%) than in Hispanic women (1.8%).<sup>77</sup> Smoking during the last 3 months of pregnancy trended higher in 20-24 year-old women (11.5%) than in any other age groups, as shown in Figure 8.<sup>78</sup>

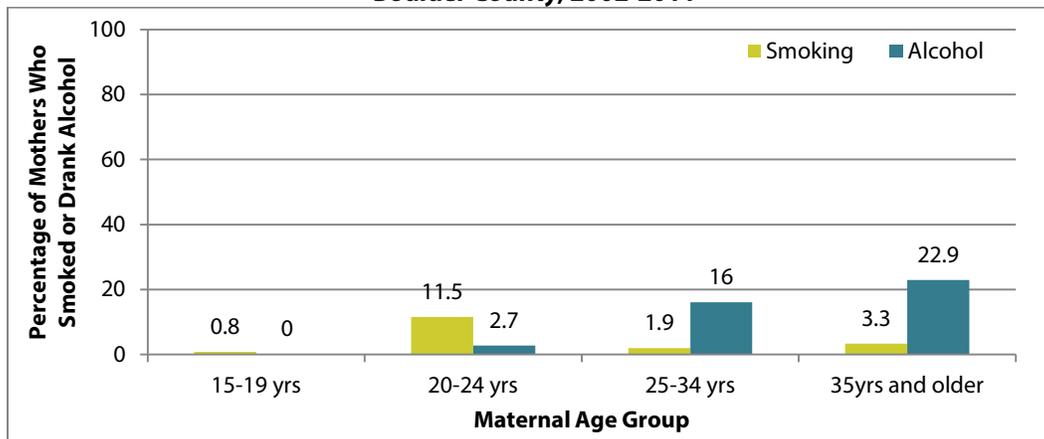
## Alcohol Use

Alcohol consumption during pregnancy increases the risk of fetal alcohol syndrome, spontaneous abortion, birth defects, and neurodevelopmental disorders.<sup>79</sup> National data show

alcohol use during pregnancy to be more prevalent among mothers with higher education, higher household income, and higher status occupations,<sup>80</sup> as well as among those women reporting an unintended pregnancy.<sup>81</sup>

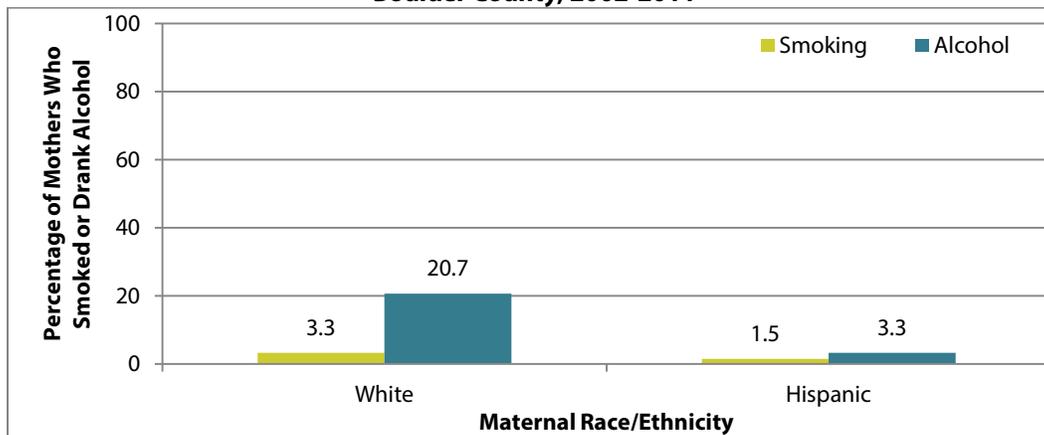
In Boulder County from 2002 through 2011, 15.1% of mothers stated they drank alcohol during the last 3 months of pregnancy, and use varied by age and race/ethnicity.<sup>82</sup> Third trimester alcohol use, shown in Figure 8, trended higher among mothers 35 years and older (22.9%) and those 25-34 years of age (16.0%), as compared to younger mothers aged 20-24 years (2.7%).<sup>83</sup> Alcohol use in the third trimester was also much more commonly reported among white mothers (20.7%) than Hispanic (3.3%) mothers, displayed in Figure 9.<sup>84</sup>

**Figure 8.**  
**Maternal Cigarette Smoking and Alcohol Consumption**  
**in Last Trimester of Pregnancy by Maternal Age Group**  
**Boulder County, 2002-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.

**Figure 9.**  
**Maternal Cigarette Smoking and Alcohol Consumption**  
**in Last Trimester of Pregnancy by Maternal Race/Ethnicity**  
**Boulder County, 2002-2011**



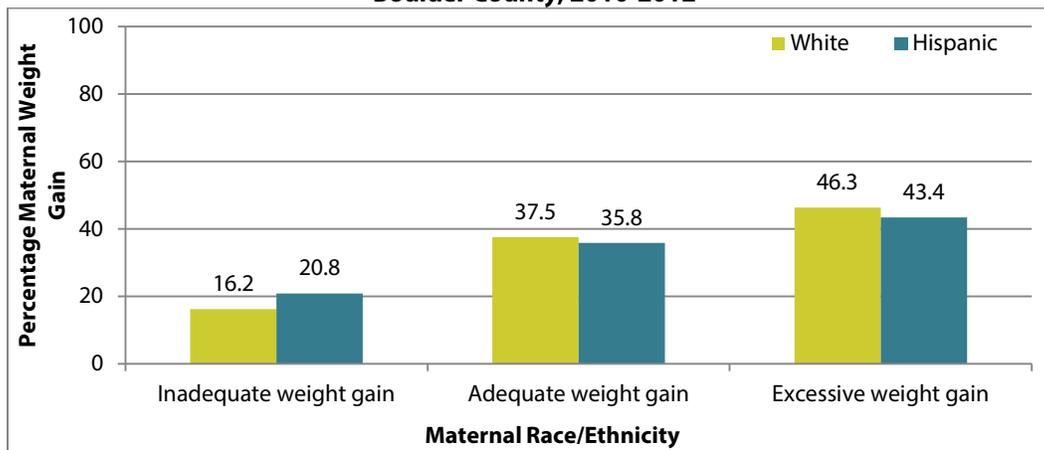
Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.

## Maternal Nutrition and Weight Gain

Maternal diet, physical activity, and pregnancy weight gain impact maternal and infant health. For instance, vegetable consumption influences birth weight; fruit consumption affects prenatal outcomes; and physical activity is related to gestational age. Institute of Medicine guidelines specify healthy weight gain ranges for women during pregnancy.<sup>85</sup> Among Boulder County live births between 2010 and 2012, 37% of mothers gained the recommended amount of weight

during pregnancy, while 45% gained more weight than is recommended, and 18% gained less than the recommended amount.<sup>86</sup> Maternal adequate and excessive weight gain were relatively equal between white and Hispanic women, while inadequate weight gain was slightly lower in white women (16%) than in Hispanic women (21%), as depicted in Figure 10.<sup>87</sup> Note that prior to pregnancy, Hispanic mothers had a much higher rate of being overweight and obese (28% and 23%, respectively) than did white mothers (18% and 10%, respectively).<sup>88</sup>

**Figure 10.**  
**Maternal Weight Gain by Race/Ethnicity**  
**Boulder County, 2010-2012**



Source: Boulder County Birth Certificate Dataset, 2010-2012, CDPHE.

A key factor in appropriate diet is access to healthy foods, which varied across our population. For instance, in Boulder County from 2010 through 2012, 26% of all mothers participated in WIC, yet just 12.5% of white mothers used WIC food during pregnancy, as compared to 70.4% of Hispanic mothers.<sup>89</sup>

## Prenatal Care

Early and continuous prenatal care helps reduce maternal and infant morbidity and mortality by identifying and addressing potential risks and by helping women to address unfavorable health behaviors.<sup>90</sup> Conversely, lack of prenatal screening, care, and counseling can negatively impact gestational age at birth, birth weight, and perinatal outcomes. Subject matter experts attested to factors influencing delayed initiation of prenatal care including denial of the pregnancy, concern about confidentiality, inability to access care, lack of knowledge regarding the importance of seeking prenatal care, and undocumented immigration status. Further, personally experienced racism inhibits the use of resources and returning to health care provider. Certain kinds of care, such as mental

health services and oral health services, can be inaccessible and costly, yet they play key roles in improving birth outcomes. Factors identified in the National Survey of Family Growth and other published literature associated late or no prenatal care with poor infant outcomes, including low birth weight, mortality, and increased health care costs.<sup>91</sup>

Eighty-five percent of women with live births in Boulder County between 2010 and 2012 entered prenatal care in the first trimester, while 14% got care after the first trimester, and less than 1% did not receive prenatal care.<sup>92</sup> The Boulder County first trimester prenatal care rate (85%) was more favorable than that of Colorado, and it exceeded the Healthy People 2020 goal.<sup>93</sup> That said, there were some differences in prenatal care between younger and older women, and between white and Hispanic women in Boulder County. Younger mothers (15-24 years) tended to delay initiation of prenatal care more than older mothers.<sup>94</sup> Prenatal care was more likely to be delayed until after the first trimester in Hispanics (20%) than in whites (11%).<sup>95</sup>

## Health Conditions

A variety of health conditions during pregnancy are risk factors for mother and newborn, including diabetes, hypertension, anemia, asthma, heart problems, obesity, depression, anxiety,<sup>96</sup> and a previous low birth weight or preterm infant. In Boulder County, among mothers with live births between 2010 and 2012, only 3% of mothers developed gestational diabetes, a rate more favorable than the Women's Health USA 2011 goal. Although the overall prevalence was low, gestational diabetes was three times higher in Hispanics (6%) than in whites (2%).<sup>97</sup> The Boulder County rate for gestational hypertension was just 5%, with percentages equal among whites and Hispanics; however, Boulder County did not meet the Women's Health USA 2011 goal.<sup>98</sup> Eclampsia was exceedingly uncommon, being present in less than 1% of Boulder County live births.<sup>99</sup> Notably, 56% (5004 of the 8,978) of live births in Boulder County between 2010 and 2012 had no risk factors noted in pregnancy.<sup>100</sup>

## Stress and Mental Health

Mental health risk factors include lack of social support, physical abuse/domestic violence, high levels of stress, major life events,<sup>101</sup> and personal experience of racism. Maternal depression may influence a mother's ability to access care, provide self-care, eat well, exercise, and maintain a healthy relationship with a partner.

Stress limits a pregnant woman's ability to practice self-care and increases the risk of depression. Of mothers giving birth between 2002 and 2011 in Boulder County, 63.1% experienced 1 or more stressors in the 12 months prior to delivery, and 19.4% experienced 3 or more stressors.<sup>102</sup> Among over a dozen types of stressors assessed in surveys, the most frequently reported were: moving to a new address (28.7%); arguing with husband more than usual (20.0%); hospitalization of a family member (18.7%); inability to pay bills (14.6%); death of a loved one (11.6%); and husband or partner lost job (11.6%).<sup>103</sup>

Inability to pay bills was especially relevant in identifying disparities. In Boulder County, the inability to pay bills among 15-19 year-old (22.1%) and 20-24 year-old mothers (31.0%) was over double that observed in women over age 25 (about 11%).<sup>104</sup> Inability to pay bills trended higher among Hispanics (21.0%) than whites (11.9%), as well.<sup>105</sup> Disparities were also evident in data on separation or divorce in the 12 months prior to delivery, which trended higher among Hispanics (11.9%) than whites (3.9%), and highest among 15-19 year-olds (22.0%), and then markedly decreased by age.<sup>106</sup>

## Perinatal and Newborn Health

A formal definition of the perinatal period varies in the literature. One approach used by the National Center for Health Statistics defines this period as beginning at the 20<sup>th</sup> week of pregnancy and extending to 28 days after birth.<sup>107</sup> Adverse outcomes commonly measured during the perinatal period include low and very low birth weight and preterm birth for newborns, as well as maternal postpartum depression. Risk factors for these conditions can potentially be identified and addressed prior to and during pregnancy and are associated with certain maternal demographic characteristics and behaviors, as well as access to health services. Hispanic women, teen women (especially Hispanic teens), women who underwent in vitro fertilization, women with multiple births (i.e. twins, triplets, etc.), and women in poverty are among the demographic groups at risk. Subject matter experts underscored that social isolation compounds difficulties of pregnancy and parenting, and cultural isolation impacts a family's ability to follow traditional practices that foster health and recovery. Further, experts pointed out that poverty can decrease both parents' sense of self-efficacy.

Mothers who suffer from depression are also more likely to have adverse outcomes. Postpartum depression can negatively impact bonding and child development. Physical abuse is a risk factor for low birth weight and morbidity and mortality in both mother and infant,<sup>108</sup> in part because domestic violence destabilizes parental capacity to meet a child's needs. Substance abuse undermines healthy coping with the stress of a newborn. Mothers who smoked cigarettes have increased risk of having infants with sudden infant death syndrome (SIDS) and respiratory tract infections.<sup>109</sup>

Mothers not breastfeeding is associated with maternal postnatal complications and poorer newborn outcomes,<sup>110</sup> which may also result in additional risk during childhood, such as for obesity. Lower breastfeeding rates tend to be more common among women with unintended pregnancies and postpartum maternal employment.<sup>111</sup> In addition to breastfeeding, length of maternity leave affects maternal mental health, as well as child development. Women are less likely to use maternal and child health services if their pregnancies are unintended.<sup>112</sup>

Subject matter experts pointed out several protective factors for positive perinatal and newborn outcomes, including term pregnancy, appropriate pregnancy weight gain (see Prenatal section), appropriate infant birth weight, and breastfeeding. Maternal education, such as around oral health, can positively impact infant and child health.

## Delivery

Of the 3,044 live births in Boulder County in 2012, 474 (15.6%) were born prior to 38 weeks gestation; 35 (1.1%) were delivered at less than 32 weeks, and 25 (0.8%) were at less than 30 weeks.<sup>113</sup> The rate of delivery at less than 32 weeks met the Healthy People 2020 goal. Nearly three quarters (74.0%) of these 3,044 births were delivered vaginally.<sup>114</sup> The rate of caesarean deliveries in Boulder County (26%) met the Women's Health USA 2011 goal. Premature rupture of membranes and/or fetal intolerance of labor (i.e., fetal distress) were present in just under 5% of live births.<sup>115</sup>

## Newborn Health

Indicators of poor newborn health that are often measured include low and very low birth weight and neonatal death. Of the 8,978 live births in Boulder County between 2010 and 2012, 7.7% (average of 229 per year) were low birth weight (<2,500 grams), and 1.2% (average of 36 per year) were very low birth weight (<1,500 grams).<sup>116</sup> The Boulder County rates of low and very low birth weight met the Healthy People 2020 goals. Since

most Boulder County live births were to mothers 30 to 44 years of age (6,001 of 8,978 births in 2010 through 2012), it is not surprising that most infants born preterm or of low birth weight were to mothers of the same age group. Preterm and low birth weight infants were also more likely to be born to white mothers in those age groups because of the overall distribution of births by race in Boulder County. However, when adjusted for the number of births by age and race, the incidence rate of low birth weight and preterm (less than 30 weeks) birth is substantially higher among Hispanic teens aged 15-19 years, as compared to white teens and all mothers aged 20-24 years.<sup>117</sup>

Of note is that between 2010 and 2012, 7,504 (83.6%) of newborns had no reported abnormal conditions.<sup>118</sup> Nevertheless, some neonatal complications were observed, as noted in Table 4. In that same time period, 9.3% (833) of newborns were admitted to the neonatal intensive care unit (NICU),<sup>119</sup> and under 1% (88) required assisted ventilation for more than 6 hours.<sup>120</sup> In 2012, the neonatal mortality rate was 2.6 deaths per 1,000 live births, or 8 of the 3,044 live births.<sup>121</sup>

**Table 4.**  
**Select Perinatal and Newborn Indicators**  
**Boulder County, 2010-2012**

Notable findings	All Races/ Ethnicities		White		Hispanic	
	#	%	#	%*	#	%*
Premature rupture of membranes	373	4.2%	244	4.1%	75	4.0%
NICU admission	833	9.3%	549	9.1%	190	10.1%
Assisted ventilation >6 hours	88	<1%	64	1.1%	10	<1%
No abnormal conditions in newborn	7,504	83.6%	5,025	83.7%	1,570	83.5%
No maternal morbidity in labor & delivery	7,961	88.7%	5,295	88.2%	1,695	90.1%

Source: Boulder County Birth Certificate Dataset, 2010-2012, CDPHE.

\*Percentage is among all live births in racial or ethnic category.

## Breastfeeding

Breast milk promotes infant health, growth, and immunity. Additionally, breastfeeding mothers may have lower risk of Type 2 diabetes and breast and ovarian cancer. The American Academy of Pediatrics recommends that infants be exclusively breastfed - without supplemental solids or liquids - for the first six months of life.<sup>122</sup> Among infants born in Boulder County in 2012, 94.6% were reported to have been breastfeeding at discharge.<sup>123</sup> The local rate surpassed the Colorado rate, as well as the Women’s Health USA 2011 and Healthy People 2020 goals. Not all mothers, however, continued to breastfeed for the recommended duration. While breastfeeding initiation is high, survey data for 2002 through 2011 show that 16.3% of mothers breastfed for 4 weeks or less; 5.1% reported duration of 5-8 weeks; and 78.6% breastfed for 9 or more weeks.<sup>124</sup>

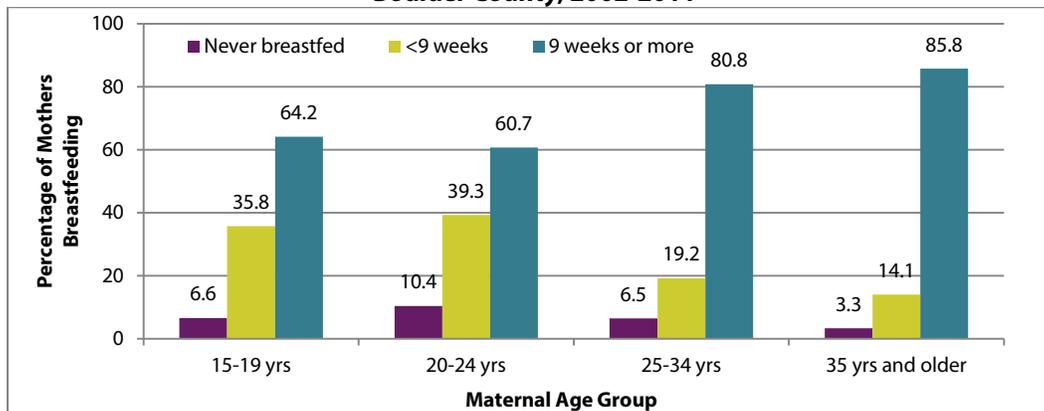
Breastfeeding practices varied considerably by maternal age, race/ethnicity, income, and maternal employment. Infants

born to white mothers aged 25 years and older were more likely to be breastfed for a longer duration. Breastfeeding duration of 4 weeks or less was seen more frequently among mothers aged 15-24 years, while breastfeeding duration of at least 9 weeks was much more common among mothers 25 years and older, as illustrated in Figure 11.<sup>125</sup>

Figure 12 shows that longer duration of breastfeeding (at least 9 weeks) was also more likely to occur among white mothers, as compared to Hispanic mothers.<sup>126</sup>

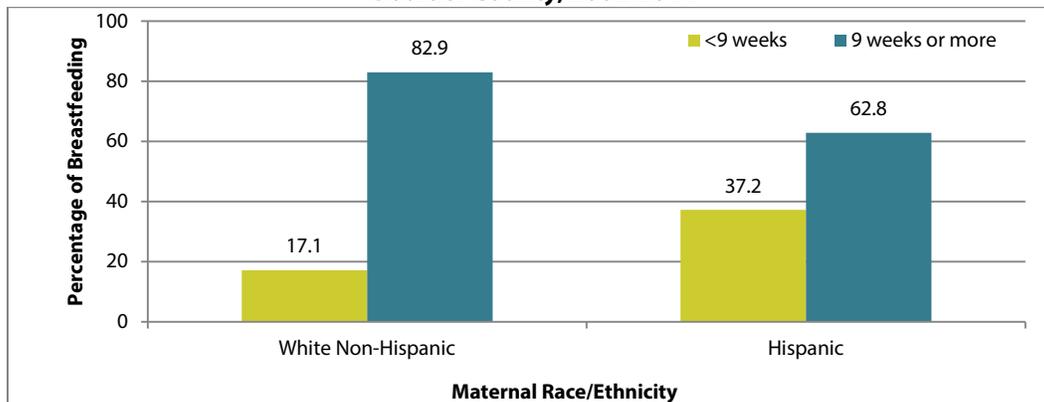
The impact of household income on breastfeeding duration is extrapolated from whether a mother participated in WIC. When comparing breastfeeding rates among WIC versus non-WIC participants in Boulder County from 2002 through 2011, initiation rates were equivalent (about 94%), but non-WIC participants were more likely to continue breastfeeding past 9 weeks.<sup>127</sup>

**Figure 11.**  
**Breastfeeding Duration by Maternal Age Group**  
**Boulder County, 2002-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.

**Figure 12.**  
**Breastfeeding Duration by Maternal Race/Ethnicity**  
**Boulder County, 2002-2011**



Source: Boulder County PRAMS Dataset, 2002-2011, CDPHE.

## Infant Care

There are many measures of infant care that extend from birth into early childhood. While this assessment did not include an exhaustive exploration of early childhood outcomes, three measures were included. The first is whether or not the new baby had health insurance. In Boulder County, 95.7% of newborns born between 2000 and 2003 had health insurance or Medicaid coverage.<sup>128</sup> Second, between 2002 and 2011, 82.0% of mothers placed their babies to sleep on their backs, the practice recommended by the American Academy of Pediatrics to decrease the risk of SIDS.<sup>129</sup> In contrast, 13.4% placed the babies to sleep on their sides, and 4.6% on their stomachs.<sup>130</sup> Third, between 2002 and 2011, only 1.3% of mothers reported that their infants were exposed to secondhand smoke, while 98.7% were not subject to this harmful exposure.<sup>131</sup>

## Maternal Physical and Mental Health

In Boulder County, labor and delivery usually occur without maternal morbidity; between 2010 and 2012, 88.7% (7,961 of

8,978) of live births reported no maternal morbidity during labor and delivery.<sup>132</sup>

While most mothers in Boulder County were physically healthy, postpartum depression was a common challenge. Although data are not as recent, previous surveys of mothers who had recently given birth demonstrate that about half (51.6%) were not depressed at all in the months after delivery, 34.1% were a little depressed, 10.8% were moderately depressed, 3.1% were very depressed, and less than 1% were very depressed and had to get help, as noted in Table 5.<sup>133</sup>

Early diagnosis and treatment are important, as postpartum depression can interfere with maternal-infant bonding and child development. Screening for depression is encouraged by the American College of Obstetricians and Gynecologists, both during and after pregnancy.<sup>134</sup> In 2009 and 2010, 67.7% of mothers in Boulder County reported that a health care provider talked with them about what to do if they felt depressed during pregnancy or after delivery.<sup>135</sup>

**Table 5.**  
**Percentage of Mothers Reporting Levels of Postpartum Depression**  
**Boulder County, 1997-1999, 2002-2003**

Levels of postpartum depression	#	%
Not depressed at all	82	51.6
A little depressed	54	34.1
Moderately depressed	27	10.8
Very depressed	9	3.1
Very depressed and had to get help	3	0.3

Source: Boulder County PRAMS Dataset, 1997-1999, 2002-2003, CDPHE.

<sup>1</sup> See [www.healthypeople.gov](http://www.healthypeople.gov).

<sup>2</sup> See [www.mchb.hrsa.gov/whusa11/](http://www.mchb.hrsa.gov/whusa11/).

<sup>3</sup> Boulder County Birth Certificate Dataset, Colorado Department of Public Health and Environment (CDPHE), 2012.

<sup>4</sup> Ibid.

<sup>5</sup> Ibid.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

<sup>8</sup> Ibid.

<sup>9</sup> Ibid.

<sup>10</sup> Ibid.

<sup>11</sup> Ibid.

<sup>12</sup> Boulder County Birth Certificate Dataset, Colorado Department of Public Health and Environment (CDPHE), 2010-2012.

<sup>13</sup> Ibid.

<sup>14</sup> Ibid.

<sup>15</sup> Ibid.

<sup>16</sup> Ibid.

<sup>17</sup> Ibid.

<sup>18</sup> Ibid.

<sup>19</sup> Ibid.

<sup>20</sup> Ibid.

<sup>21</sup> Ibid.

<sup>22</sup> Ibid.

<sup>23</sup> Ibid.

<sup>24</sup> U.S. Department of Health and Human Services Health Resources and Services Administration, "Women's Health USA 2011," October 2011, <[http://insidebc/sites/health/secure/Assessment%20HIP/Lucy\\_Women%27s%20Health%202011%20MCHB.pdf](http://insidebc/sites/health/secure/Assessment%20HIP/Lucy_Women%27s%20Health%202011%20MCHB.pdf)> accessed on June 10, 2014.

L. B. Finer and S. K. Henshaw, "Disparities in rates of unintended pregnancy in the United States, 1994 and 2001." *Perspectives on Sexual and Reproductive Health*, 38 (2), 2006, pp. 90-96.

<sup>25</sup> A. Shupe, et al., "The importance of local data in unintended pregnancy prevention programming." *Maternal and Child Health Journal*, Vol. 4, No. 3, September 2000, pp. 209-214.

<sup>26</sup> *The Best Intentions: Unintended Pregnancy and the Well Being of Children and Families*, National Academy Press, Washington D.C., 1995, Chapter 3, "Consequences of unintended pregnancy," pp. 50-82.

<sup>27</sup> Women's Health USA 2011.

<sup>28</sup> The Best Intentions, pp. 50-82.

<sup>29</sup> R. Bolden "The State of Adolescent Sexual Health in Colorado." *Colorado Youth Matter*, Denver, CO, May 2014.

<sup>30</sup> L. B. Finer and M. R. Zolna, "Unintended Pregnancy in the United States: Incidence and Disparities, 2006." *Contraception*, 2011, Vol. 84, No. 5, pp. 478-485. Finer, 2006, pp. 90-96.

<sup>31</sup> Ibid.

<sup>32</sup> Ibid.

<sup>33</sup> The Best Intentions, pp. 50-82.

<sup>34</sup> Women's Health USA 2011.

<sup>35</sup> Ibid.

<sup>36</sup> L. B. Finer and M. R. Zolna, "Unintended Pregnancy in the United States: Incidence and Disparities, 2006," *Contraception*, 2011, Vol. 84, No. 5, pp. 478-485.

<sup>37</sup> The Best Intentions, pp. 50-82.

<sup>38</sup> Boulder County Pregnancy Risk Assessment Monitoring System (PRAMS) Dataset, Colorado Department of Public Health and Environment (CDPHE), 2002-2011.

<sup>39</sup> L. B. Finer and M. R. Zolna, "Shifts in intended and unintended pregnancies in the United States, 2001-2008," *American Journal of Public Health*, February 2014, Vol. 104, No. S1, pp. S43-S48.

<sup>40</sup> Boulder County PRAMS, 2002-2011.

<sup>41</sup> Ibid.

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

<sup>48</sup> Ibid.

<sup>49</sup> Ibid.

<sup>50</sup> Ibid.

<sup>51</sup> Ibid.

<sup>52</sup> Ibid.

<sup>53</sup> Women's Health USA 2011.

<sup>54</sup> "Preconception and Interconception Health Status of Women Who Recently Gave Birth to a Live-Born Infant — Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 26 Reporting Areas, 2004," *Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report (MMWR)*, Surveillance Summaries, December 14, 2007, Vol. 56, No. SS-10.

<sup>55</sup> Ibid.

<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

<sup>58</sup> Boulder County Birth Certificate Dataset, 2010-2012.

<sup>59</sup> Ibid.

<sup>60</sup> Carol S. Weisman et al., "Preconception Predictors of Birth Outcomes: Prospective Findings from the Central Pennsylvania Women's Health Study," *Maternal Child Health Journal*, May 27, 2009.

<sup>61</sup> Boulder County Birth Certificate Dataset, 2010-2012.

<sup>62</sup> Ibid.

<sup>63</sup> Women's Health USA 2011.

<sup>64</sup> Boulder County PRAMS, 2002-2011.

<sup>65</sup> Ibid.

<sup>66</sup> Ibid.

<sup>67</sup> Women's Health USA 2011.

<sup>68</sup> "Monitoring Progress Toward Achieving Maternal and Infant *Healthy People 2010* Objectives — 19 States, Pregnancy Risk Assessment Monitoring System (PRAMS), 2000–2003," *Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report (MMWR)*, Surveillance Summaries, October 6, 2006, Vol. 55, No. SS-9.

<sup>69</sup> MMWR, 2006.

<sup>70</sup> A. Chandra, "Health aspects of pregnancy and childbirth: United States, 1982–88," National Center for Health Statistics, *Vital Health Stat, Series 23: Data From the National Survey of Family Growth*, No. 18, 1995. [percentages are from 1984-1988 surveys].

<sup>71</sup> PRAMS, 2001.  
L. B. Finer, 2006, pp. 90-96.  
A. P. Mohllajee et al., "Pregnancy Intention and Its Relationship to Birth and Maternal Outcomes," *Obstetrics & Gynecology*, March 2007, Vol. 109, No. 3, pp. 678-686.  
Healthy People 2010 Objectives, 2006.

<sup>72</sup> Boulder County PRAMS, 2002-2011.

<sup>73</sup> Boulder County Birth Certificate Dataset, 2010-2012.

<sup>74</sup> Ibid.

<sup>75</sup> Ibid.

<sup>76</sup> Ibid.

<sup>77</sup> Ibid.

<sup>78</sup> Boulder County PRAMS, 2002-2011.

<sup>79</sup> PRAMS Report, 2001.  
Finer, 2006, pp. 90-96.  
Mohllajee, 2007.  
Healthy People 2010 Objectives, 2006.

<sup>80</sup> Chandra, 1995.

<sup>81</sup> Healthy People 2010 Objectives, 2006.

<sup>82</sup> Boulder County PRAMS, 2002-2011.

<sup>83</sup> Ibid.

<sup>84</sup> Ibid.

<sup>85</sup> "Weight Gain During Pregnancy: Reexamining the Guidelines," Institute of Medicine, Report Brief, 2009, <[www.iom.edu/pregnancyweightgain](http://www.iom.edu/pregnancyweightgain)> accessed on June 11, 2014.

<sup>86</sup> Boulder County Birth Certificate Data, 2010-2012.

<sup>87</sup> Ibid.

<sup>88</sup> Ibid.

<sup>89</sup> Ibid.

<sup>90</sup> Boulder County PRAMS Report, 2001.

<sup>91</sup> Healthy People 2010 Objectives, 2006.

<sup>92</sup> Boulder County Birth Certificate Data, 2010-2012.

<sup>93</sup> Ibid.

<sup>94</sup> Ibid.

<sup>95</sup> Ibid.

<sup>96</sup> A. S. Bryant et al., "Racial/Ethnic Disparities in Obstetrical Outcomes and Care: Prevalence and Determinants," *American Journal Obstetrics and Gynecology*, April 2010, Vol. 202, No. 4, pp. 335–343.

<sup>97</sup> Boulder County Birth Certificate Data, 2010-2012.

<sup>98</sup> Ibid.

<sup>99</sup> Ibid.

<sup>100</sup> Ibid.

<sup>101</sup> Bryant, 2009.

<sup>102</sup> Boulder County PRAMS, 2002-2011.

<sup>103</sup> Ibid.

<sup>104</sup> Ibid.

<sup>105</sup> Ibid.

<sup>106</sup> Ibid.

<sup>107</sup> "Standard Terminology for Fetal, Infant, and Perinatal Deaths," *Journal of the American Academy of Pediatrics*, July 1, 2011, Vol. 128, No. 1, pp. 177-181, <<http://pediatrics.aappublications.org/content/128/1/177.full>> accessed on June 11, 2014.

<sup>108</sup> MMWR, 2006.

<sup>109</sup> Healthy People 2010 Objectives, 2006.

<sup>110</sup> Ibid.

<sup>111</sup> Shupe, pp. 209-214.  
T. D. Dye et al., "Unintended Pregnancy and Breast-Feeding Behavior," *American Journal of Public Health*, October 1997, Vol. 87, No. 10, pp. 1709-1711.

<sup>112</sup> Shupe, pp. 209-214.

<sup>113</sup> Boulder County Birth Certificate Dataset, 2012.

<sup>114</sup> Ibid.

<sup>115</sup> Ibid.

<sup>116</sup> Ibid.

<sup>117</sup> Ibid.

<sup>118</sup> Ibid.

<sup>119</sup> Ibid.

<sup>120</sup> Ibid.

<sup>121</sup> Boulder County Birth Certificate Data, 2012.

<sup>122</sup> Women's Health USA 2011.

<sup>123</sup> Boulder County Birth Certificate Data, 2012.

<sup>124</sup> Boulder County PRAMS, 2002-2011.

<sup>125</sup> Ibid.

<sup>126</sup> Ibid.

<sup>127</sup> Ibid.

<sup>128</sup> Boulder County PRAMS, 2000-2003.

<sup>129</sup> Boulder County PRAMS, 2002-2011.

<sup>130</sup> Ibid.

<sup>131</sup> Ibid.

<sup>132</sup> Boulder County Birth Certificate Data, 2010-2012.

<sup>133</sup> Boulder County PRAMS, 1997-2002, 2002-2003.

<sup>134</sup> Women's Health USA 2011.

<sup>135</sup> Boulder County PRAMS, 2009-2010.