

Pregnancy as an Optimal Time for Health Improvement:
Creating Interventions to Benefit Maternal and Fetal Health
Long-Term

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DEDICATION

“The woods are lovely, dark and deep.

But I have promises to keep,

And miles to go before I sleep,

And miles to go before I sleep.

Perhaps the promise has been made to ‘Ethics’ or ‘Morality’ itself. *Morality* demands that we act *morally*, that we further moral interests; this entails that we leave the woods, the snow, and the glowing darkness. Civilization and its governing morality have placed a yoke upon the narrator’s neck. He must earn a livelihood, provide for others, and contribute to humanity’s great onward march. He must build and create.”

-Rav Aharon Lichtenstein, “The Woods are
Lovely, Dark and Deep”: Reading a Poem
by Robert Frost

This thesis is dedicated to my sister, Yedida. Who faced cancer this year with resilience. Who taught me that appreciation for the beauty in life, for the dark, deep woods, is not independently sufficient to sustain us when suffering inevitably arrives. There are promises to keep, moral responsibilities to humanity required of us that allow us an opportunity to make suffering worth something. Yedida, this is the start of my lifelong journey to attempt to make your suffering worth something.

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ABSTRACT

America is experiencing a major healthcare crisis. Stroke, heart disease, diabetes, and cancer are common diseases that contribute to both the morbidity and mortality rate in the United States. Primary and secondary prevention measures include healthy eating, exercise, vaccinations, and screening for disease. Annual "well-woman visits" provide an opportunity to address these measures. However, only 73% of women have attended a routine visit in the last two years¹. Pregnancy is an optimal time for women to improve their health. The recommended number of outpatient visits in pregnancy is 11 by 36 weeks of gestation followed by additional weekly visits until childbirth². Each visit presents an opportunity for health education, motivational interviewing to promote positive health habits, vaccination, and to screen for diseases ranging from cervical cancer to diabetes. Additionally, pregnant women are often motivated to promote their health for fetal benefit³. Pregnancy is an optimal time for women to undergo interventions to improve their overall health and prevent disease. Previous successful evidenced-based interventions, including studies aimed at limiting alcohol consumption and smoking during pregnancy, can be used as a starting point for creating new interventions to educate women on primary and secondary prevention measures and assist them in implementation into their lives.

INTRODUCTION

Common diseases contributing to morbidity and mortality in women in the United States are often exacerbated by pregnancy or initially diagnosed during the prenatal period, making pregnancy an optimal time for women to improve their health⁴. More women seek out medical care during pregnancy giving them the opportunity to be screened and treated for diseases as well as receive recommended vaccinations⁵. Furthermore, women are more receptive to health messaging and willing to make healthy lifestyle changes during this period as they are motivated for the sake of the baby³. However, a limited number of effective interventions exist to assist women in implementing healthy lifestyle habits during pregnancy including diet and exercise, and to encourage women to attend all prenatal outpatient visits. Multiple interventions preventing alcohol consumption and smoking during pregnancy currently exist and have been in use for decades. Determining the factors that contribute to success and failure rates of interventions preventing alcohol consumption and smoking during pregnancy can be useful in creating effective interventions promoting healthy lifestyle changes and encouraging women to attend all prenatal doctor appointments.

COMMON CONTRIBUTIONS TO MORBIDITY AND MORTALITY RATES IN WOMEN

CARDIOVASCULAR HEALTH

Every year, over 877,500 Americans die as a result of cardiovascular disease, with the two major causes being heart disease and stroke⁶. In 2016, one in three cardiovascular events occurred in adults between the ages 35-64, with an estimated 80% of premature heart disease and strokes being preventable⁷. People can minimize the likelihood of an adverse cardiovascular

event occurring by addressing significant risk factors and making lifestyle changes. Risk factors for cardiovascular disease include high blood pressure, high cholesterol, diabetes, smoking and secondhand smoke exposure, obesity, unhealthy diet, and physical inactivity.

Heart Disease

For the last 70 years, heart disease has been the leading cause of death in the United States⁸. It is estimated that over 60 million women in the United States are living with a form of heart disease, which makes up 44% of the female population⁹. One in every five female deaths in the United States in 2020 was caused by heart disease, leading to a total of 314,186 women dying as a result of heart disease. Coronary artery disease is responsible for the majority of these deaths, which is caused by plaque buildup in the walls of the arteries carrying blood to the heart. Plaque is formed by cholesterol deposits and other substances in the bloodstream. These deposits cause the inside of the artery to narrow over time, which eventually can block the flow of blood to the heart, causing a heart attack. Since the heart is working harder to push blood through the narrowed artery, coronary artery disease can also weaken the heart muscle over time, leading to heart failure¹⁰.

The greatest risk factor for heart disease in women is hypertension, or high blood pressure. More than 44.3% of women in the United States are taking blood pressure medication or have high blood pressure, which is defined as 130/80 mm Hg and above. While hypertension is a common condition in the United States, it often goes underdiagnosed in women, and less than one in four women with high blood pressure are keeping it under control. Other risk factors for heart disease include elevated low-density lipoprotein (LDL) cholesterol, diabetes, smoking, obesity, unhealthy diet, insufficient exercise, drinking a large amount of alcohol, stress, and

depression. Women can significantly reduce their risk of developing heart disease by keeping their blood pressure in check, getting at least 150 minutes of physical activity weekly, eating a healthy diet, limiting alcohol intake, quitting smoking, managing stress levels, being screened for diabetes, and having their cholesterol and triglycerides monitored by a doctor⁹.

Stroke

Stroke is the fifth most common cause of death in the United States and is responsible for 150,000 of the cardiovascular disease related deaths each year¹¹. Alarming, statistics show that one in five women between the ages of 55-75 will suffer from a stroke¹², and having one stroke greatly increases the risk of having recurrent strokes. While not everyone who has a stroke will die as a result, stroke is also the leading cause of serious long-term disability in the United States. A stroke, also referred to as a brain attack, causes brain tissue to die due to lack of sufficient oxygen, and can happen in one of two ways. An ischemic stroke occurs when the flow of blood carrying oxygen to the brain is blocked by a blood clot, and a hemorrhagic stroke occurs when a blood vessel inside the brain ruptures.

Similarly to heart disease, 80% of strokes are preventable by making lifestyle changes to decrease risk by addressing common risk factors. The number one risk factor for stroke is hypertension, and a person can control their blood pressure by eating nutritious, low sodium, high fiber foods, and taking blood pressure medication as prescribed. High cholesterol levels in the blood also increases the risk for stroke, as, like in the case of heart disease, cholesterol deposits cause plaque to build up in arteries which narrows the flow of blood and could cause blockages. Regular physical activity is also necessary to keep the heart and blood vessels healthy which largely decreases the risk of stroke¹³.

CANCER

Cancer is the second leading cause of death in the United States, with a total of 602,350 Americans dying from cancer in 2020¹⁴. 284,619 of these deaths were among females and 317,731 of these deaths were among males. 63,135 females died from lung cancer, 42,275 from breast cancer, 23,826 from colorectal cancer, 22,495 from pancreatic cancer, and 9,591 from liver and intrahepatic bile duct cancer. While the majority of these cancers have a high death rate among both genders, breast cancer specifically has a much higher incidence and death rate in women. Cancers specific to women include endometrial, cervical, and ovarian cancers. Cancer is a disease caused by uncontrolled growth of one of the body's cells, eventually forming a tumor, which can invade nearby areas and spread to other organs throughout the body¹⁵. Being knowledgeable and educated about risk factors for cancer and screening options can help women prevent cancer completely or catch it in its early stages, when the tumor is small and has not yet spread to other organs, making it easier to treat in the vast majority of cases¹⁶.

Breast cancer is one of the most common cancers in American women, with a one in eight chance that a female will develop cancer in her lifetime¹⁷. Although in recent years incidence rates have been increasing, death rates as a result of breast cancer have simultaneously been decreasing, due to catching breast cancer early through screening, greater awareness, and better treatment options. The American Cancer Society provides specific recommendations by age of how often women should get mammograms, x-rays of the breast, beginning at age 40. All women are recommended to be familiar with the normal look and feel of their breasts and communicate with a doctor in the case of anything unusual. Women who have multiple risk factors including family history or a genetic mutation are recommended to be screened with MRI

along with the mammogram¹⁶.

Cervical cancer is another type of cancer in women that is often preventable and has a far better prognosis if caught early. Becoming infected by the sexually transmitted infection, human papillomavirus (HPV) is the main risk factor for cervical cancer. As a preventative measure, it is recommended that children between the ages of 9-12 be vaccinated for HPV, as well as anyone between the ages of 13-26 who has not yet been vaccinated. Furthermore, beginning at the age of 25, all women should be regularly screened for cervical cancer. This includes the HPV test, which finds HPV infections that could eventually cause cancer, and the Pap test, which finds cancerous changes in the cervix¹⁸.

DIABETES

In 2019, diabetes was considered to be the seventh leading cause of death in the United States, with 87,647 death certificates reporting diabetes as the underlying cause of death and 282,801 death certificates listing diabetes as a contributing factor¹⁹. According to the American Diabetes Association, 11.3% of the population had diabetes in 2019. Additionally, 96 million Americans 18 years old and older were in the prediabetic category based on elevated blood sugar levels. Type 1 diabetes refers to the complete deficiency of insulin production, and both the cause and preventative measures remain unknown. Type 2 diabetes, however, is far more common in the United States population and is often preventable. Type 2 diabetes is characterized by the body ceasing to use insulin appropriately to lower blood sugar. If left improperly managed, type 2 diabetes will eventually cause serious harm to the body, particularly to the nervous and circulatory systems. Risk factors for type 2 diabetes include being overweight, insufficient physical activity, and genetic disposition²⁰.

In females, having diabetes increases the risk of heart disease by about four times and puts women at risk for complications including blindness, kidney disease, vaginal yeast infections, urinary tract infections, and depression. Additionally, hormonal changes surrounding a woman's menstrual cycle and menopause can make blood sugar levels unpredictable thereby making diabetes more challenging to manage²⁰.

PREGNANCY AS AN OPTIMAL TIME FOR HEALTH IMPROVEMENT

The physiological and psychological changes happening in a woman's body during pregnancy have the potential to both positively and negatively impact her cardiovascular health and risk factors for cancer and diabetes. Potential side effects of pregnancy, recommended number of doctor's visits during the prenatal period, vaccinations offered, tests and screenings done, and potential health impact on the fetus contribute to creating an optimal time for health improvement. Two of the most common adverse side effects of pregnancy are hypertension and gestational diabetes²¹. In the United States, high blood pressure develops in one in every eight pregnancies, and pregnant women who have high blood pressure have double the risk of developing heart disease later in life than pregnant women who did not develop this condition⁹. Women who have high blood pressure during pregnancy are also at an elevated risk for stroke¹³. Gestational diabetes, defined as high blood sugar during pregnancy, occurs in 2%-10% of pregnancies in the United States placing a woman at higher risk for developing type 2 diabetes later in life. Both hypertension and gestational diabetes are routinely screened for during pregnancy, providing an opportunity for health education and motivational interviewing to promote healthy lifestyle changes when a woman is at risk of developing one of these conditions or has already been diagnosed²².

Furthermore, certain vaccinations are recommended during pregnancy to protect the fetus, offering the same immunity benefits to the mother. There are also many tests done as part of routine prenatal care including complete blood count, urinalysis, and testing for sexually transmitted infections and tuberculosis²³. Mental health screenings²⁴ and cervical cancer screenings are routine tests done during prenatal visits²⁵, and routine ultrasounds during pregnancy could reveal cancer in other areas such as the ovaries²⁶. Additionally, as the lifestyle habits of the mother during pregnancy affects the baby's health, pregnant women are often psychologically motivated to implement healthier eating and exercising habits³.

MOTIVATION TO CHANGE BEHAVIORS

A woman's health during pregnancy directly impacts the health of the fetus and can have enduring effects on both the mother and baby³. Adverse maternal and neonatal outcomes include hypertension, gestational diabetes, preterm birth, impaired fetal development, miscarriage, stillbirth, postpartum depression²⁷, neonatal mortality, and inadequate neurological development of the child²⁸. Women tend to feel responsible to have a healthy pregnancy and are thereby motivated to implement healthy lifestyle habits during pregnancy including a nutritious diet, regular physical activity, reducing alcohol consumption, and quitting smoking and use of illicit drugs²⁹.

LIFESTYLE CHANGES

Healthy Eating

A nutritious, balanced maternal diet both before pregnancy and during the prenatal period is associated with health of the fetus, proper birth weight, and increased survival rate of both the mother and baby³⁰. It is recommended that pregnant women follow a healthy dietary pattern rich

in vegetables, fruits, fat-free or low-fat dairy products, selected fish, and other lean proteins. Food and drinks that are high in added sugar, saturated fat, and sodium should be kept to a minimum as well as foods like white bread, cookies and cake that are made of refined grains and starches. A maternal diet that is high in fat and sugar leads to increased incidence of metabolic syndrome, diabetes, and cardiovascular disease for the offspring later in life. A diet high in red meat, fish with elevated mercury levels, too much caffeine, and any amount of alcohol is considered harmful to the baby³¹.

Pregnant women require greater amounts of nutrients like protein, iron, folic acid, iodine, and calcium³¹. Folic acid can be supplemented already prior to conception and should be continued through at least the first month of pregnancy as a preventative measure for neural tube defects³⁰. Women who smoke should take vitamin C supplements during pregnancy to lower the incidence of asthma and wheezing in the offspring. Iodine should be taken by all pregnant women to reduce the incidence of hypothyroidism and neurological development impairments in the fetus³². Appropriate calcium supplementation lowers the risk of hypertension and preeclampsia in the mother during pregnancy³⁰.

Along with a nutritious diet, a pregnant woman is recommended to eat the appropriate number of calories during each trimester. During the first trimester, weeks 1-12, it is recommended that a woman not increase caloric intake. During the second trimester, weeks 13-26, it is recommended that a woman intake an extra 340 calories per day. During the third trimester, week 26 until delivery, it is recommended that a woman intake an extra 450 calories per day³¹. Generally, current guidelines suggest that women should gain at least 15 lb during pregnancy. However, all of these recommendations vary person by person. For obese women,

defined as having a body mass index of 30 kg per m² or greater, little to no weight gain is recommended to lower risk of preeclampsia and cesarean delivery and for the most favorable pregnancy outcomes³³.

Maternal dietary patterns are not just associated with favorable pregnancy outcomes, but can have an effect on the child's growth in the early years of life. Childhood obesity is currently a major public health concern in the United States and is considered to have reached epidemic levels with 17% of children presenting with obesity³⁴. Unhealthy maternal dietary patterns during pregnancy, being the primary fetal energy source, are identified as a key early-life risk factor for the disease. Maternal diets high in white bread, red and processed meats, fried chicken, and french fries are associated with a higher BMI for age at one and three years of age as well as a higher risk of being overweight or obese at three years of age in comparison to a maternal diet high in fruits, vegetables, low-fat dairy, whole-wheat bread, baked chicken, and water³⁵.

Exercise

The American College of Obstetricians and Gynecologists states that it is both safe and beneficial for a woman with a healthy, normal pregnancy to continue or start regular physical exercise, with no associated risk of miscarriage, low birth weight, or early delivery. Exercise during pregnancy has the benefits of reducing back pain and constipation, decreasing risk of preeclampsia, gestational diabetes, and cesarean delivery, improving fitness while strengthening heart and blood vessels, and promoting healthy weight gain during pregnancy while helping a woman lose weight in the postpartum period³⁶. Research also shows that exercise reduces the risks of preterm birth, a small for gestational age baby, and a large for gestational age baby²⁹. It is recommended that a pregnant woman perform aerobic exercise for at least 150 minutes weekly

with moderate intensity. Women should choose exercises with caution that take into account the changes their bodies will be going through during pregnancy. Pregnancy hormones cause relaxation of ligaments supporting the joints throughout the body, making the joints more mobile and at risk of being injured. Additionally, a woman's center of gravity shifts during pregnancy as the fetus grows causing her to become less balanced and at risk of falling. Lastly, pregnant women require greater amounts of oxygen than the average person which may affect ability to perform strenuous exercise³⁶.

Excessive maternal weight gain during the pregnancy period is associated with higher risk of adverse pregnancy outcomes³⁷. While a healthy diet plays a large role in weight gain during pregnancy³¹, exercise throughout pregnancy can help to prevent excessive weight gain during this period. Furthermore, results of studies indicate that regular physical activity during pregnancy is associated with lower risk of developing gestational diabetes³⁷.

Meta-analysis studies have shown that exercise does not just have strong positive effects on the mother during pregnancy while decreasing adverse birth outcomes, but is also associated with offspring health from fetal development into adulthood. The vast majority of research reports that in response to maternal exercise, offspring experience health benefits such as decreased risk of metabolic syndrome, cardiovascular disease, and even certain types of cancer³⁸. There is also a reduced risk of childhood obesity in babies born to mothers of a normal weight who exercised during pregnancy²⁹.

SCREENING FOR DISEASES

Screening enables women to receive timely diagnoses for diseases and access medical treatment and care that can have long term health consequences³⁹. Annual "well-woman visits"

provide an opportunity for doctors to screen for cardiovascular disease, hypertension, diabetes, sexually transmitted infections, cancer, and mental health. However, only 73% of American women have attended a routine visit in the last two years¹. As pregnant women are recommended to see a doctor very regularly until delivery, pregnancy is an optimal time for women to be screened for both pre existing diseases and those that have developed during the prenatal period. The recommended number of outpatient visits in pregnancy is 11 by 36 weeks of gestation followed by additional weekly visits until childbirth².

Hypertensive Disorders

Hypertension is potentially harmful in any individual as it is the most common risk factor for cardiovascular disease. For pregnant women, however, hypertension adds additional risk to both the mother and the baby. It is important that a woman with high blood pressure seek treatment to adjust her blood pressure to a normal range before becoming pregnant in order to minimize risk for pregnancy complications that can arise from hypertension including preeclampsia, eclampsia, stroke, and preterm birth⁴⁰.

Gestational hypertension is high blood pressure, measured at 140/90 mm Hg and above, that develops in pregnancy and occurs in about 6% of all pregnancies⁴¹. Every pregnant woman is considered to be at risk for developing high blood pressure⁴² and should be screened for hypertension throughout the prenatal period⁴⁰. Gestational hypertension is considered to be a significant health concern in pregnancy as high blood pressure increases resistance in blood vessels which can obstruct blood flow to the liver, kidneys, brain, uterus, and placenta. In the most serious cases gestational hypertension can cause placental abruption, where the placenta prematurely detaches from the uterus, growth restriction of the fetus, and stillbirth⁴¹.

Gestational hypertension puts a woman at risk for developing preeclampsia, a condition that occurs in about 1 in 25 pregnancies in the United States⁴⁰. Preeclampsia is diagnosed when a woman has both high blood pressure and protein in her urine. It occurs most commonly in women over the age of 35, women pregnant with multiple babies, women who had hypertension prior to pregnancy, women who had hypertension in a previous pregnancy, women with diabetes, and obese women. Preeclampsia also commonly occurs in younger women during their first pregnancy. Symptoms of preeclampsia include a chronic headache, changes in vision, upper abdominal pain, nausea, vomiting, edema, and trouble breathing. Some women, however, will not develop symptoms of preeclampsia, which is why it is critical that pregnant women visit their doctor regularly. Eclampsia is the most severe version of preeclampsia, a condition that causes seizures and can lead to the death of the mother and fetus. Due to this danger, doctors evaluate the risk and determine if the baby needs to be delivered early⁴¹.

Gestational Diabetes

Gestational diabetes is the development of diabetes during pregnancy in a woman who did not previously have the condition. It is estimated that 2-10% of pregnancies in the United States are affected by gestational diabetes annually⁴³. Pregnancy causes the body to go through hormonal and weight changes that can affect the body's ability to use insulin appropriately which can lead to insulin resistance, causing gestational diabetes. Having risk factors for type 2 diabetes prior to pregnancy, including prediabetes, being overweight, and not being sufficiently physically active⁴⁴, increases a woman's risk for developing gestational diabetes.

Gestational diabetes typically does not have symptoms⁴³, which is why it is recommended that all pregnant women be screened for the disease. A woman at average risk for

gestational diabetes will be screened between 24 and 28 weeks of pregnancy, while a woman at high risk may be tested during her first prenatal visit. Routine gestational diabetes screening includes an initial glucose challenge test where the pregnant woman drinks a solution that is high in glucose. A blood test is done an hour later to determine blood sugar levels, with a level below 140 mg/dL considered to be in the normal range. If the blood sugar levels are higher than the indicated parameter, a follow up glucose tolerance test is done with an additional sugar solution. Multiple elevated blood sugar level readings are indicative of evidence of gestational diabetes⁴⁵.

A diagnosis of gestational diabetes puts both the mother and fetus at risk for related health problems. For the mother, gestational diabetes increases the risk of developing high blood pressure as well as increases the risk of the baby being born large thereby requiring delivery by cesarean section. Besides the risk of being born large, the baby is also at risk of being born early, which increases the risk of breathing issues, having low blood sugar, and developing type 2 diabetes later in life⁴³.

Sexually Transmitted Infections

Sexually transmitted infections (STIs) include over 30 bacteria, parasites, and viruses that can be transmitted through vaginal, anal, or oral sexual contact. There are eight known pathogens that serve as the most common causes of incidence of a sexually transmitted infection including four currently incurable viral infections: hepatitis B, herpes simplex virus (HSV), human immunodeficiency virus (HIV), and human papillomavirus (HPV). The other four pathogens are considered to be curable: chlamydia, gonorrhea, syphilis, and trichomoniasis. Not only does contracting a sexually transmitted infection cause serious and potentially life threatening symptoms, but there are consequences beyond the illness itself. Herpes, gonorrhea, and syphilis

are all risk factors for contracting HIV, and gonorrhea and chlamydia are two of the main causes in women of pelvic inflammatory disease and infertility⁴⁶. Additionally, HPV is responsible for over 90% of cervical and anal cancers and 70% of vulvar, vaginal and oropharyngeal cancers. Sexually transmitted infections can also be transmitted through pregnancy, childbirth, and breastfeeding from a mother to her baby, putting the fetus at risk for stillbirth, neonatal death, low-birth weight, prematurity, sepsis, congenital deformities, and neonatal conjunctivitis⁴⁷.

As sexually transmitted infections can be transmitted perinatally, women are recommended to be screened periodically throughout the pregnancy period for the most common infections. Screening allows for timely diagnoses which provides access to treatment that can protect the fetus from contracting the disease and prevent short-term and long-term health consequences³⁹. During the first prenatal visit to the doctor, all pregnant women are recommended to be screened for syphilis, HIV, hepatitis B, and hepatitis C. Women under the age of 25 and those at an older age with increased risk are recommended to be tested for an additional two infections: chlamydia and gonorrhea. During the third trimester, repeat STI screening is done for certain groups of pregnant women and those with ongoing risk factors. At the time of delivery, pregnant women who were not previously screened for HIV, Hepatitis B, and Hepatitis C are screened, and women who were not previously screened for syphilis, were at risk of contracting the infection during pregnancy, or deliver a stillborn baby are screened for syphilis⁴⁸.

Cancer

Cervical cancer is routinely screened for in pregnant women, most commonly performed at the initial prenatal visit. A Pap test is performed to screen for abnormal cervical cells that have

a higher risk of becoming malignant. Though Pap tests cannot diagnose cancer, they have been proven to detect about 95% of cervical cancers at an early enough stage that they can be treated and, in most cases, cured. Pap tests do not pose a risk to the fetus, and, in the case of an abnormal Pap result, many treatments can be done safely during pregnancy. In some cases, delaying treatment until after the baby is born is an option. Oftentimes, however, the baby being delivered through the cervix and vaginal canal washes away abnormal cells of the cervix and follow up screening may be recommended in the postpartum period²⁵.

Routine prenatal visits to the doctor also provide an opportunity to ensure any changes a woman's breasts are undergoing during pregnancy are normal and are not a sign of breast cancer. It is expected during pregnancy that breasts will double in size as they develop milk ducts for breastfeeding, and breast tissue can begin to feel firmer and lumpy. While the majority of lumps found during pregnancy are not breast cancer, there are screening tests that are considered safe to be done during pregnancy in the case of a suspicious lump. An ultrasound will likely be the first test done and can accurately differentiate between a harmless cyst and a solid mass that may be cancerous. If further testing is needed, mammograms are considered to be fairly safe during pregnancy according to the American Cancer Society, as only a small amount of radiation is used⁴⁹.

Mental Health

Depression is the most common mood disorder diagnosed in the general population and is almost twice as common in women as it is in men. The initial onset tends to be during the reproductive years for women. Mood disorders, including depression, anxiety, and bipolar, can be extraordinarily challenging for families to deal with, and, if not treated correctly, can lead to

devastating consequences⁵⁰. The American College of Obstetricians and Gynecologists recommends that all pregnant women be screened for mental health conditions²⁴. Perinatal major and minor depressive episodes, which can occur from the time of pregnancy until a year after delivery, are considered to be common medical complications. Without proper diagnosis and treatment, perinatal depression could lead to thoughts of suicide or harming the baby⁵¹. Maternal suicide is responsible for more deaths than hypertensive disorders and hemorrhage⁵².

Women are recommended to be screened for depression and anxiety at least once during the prenatal period, with a follow up during the postpartum period. Within the first 12 weeks following birth, women should be given a comprehensive assessment including the physical, social, and psychological aspects of wellbeing²⁴. In screening for depression, a questionnaire called the Edinburgh Postnatal Depression Screen is most commonly used. It contains 10 multiple choice questions asking a woman about her emotions over the past 7 days, with the final question specifically asking about suicidal thoughts⁵³.

Common risk factors for depression during pregnancy include maternal anxiety and life stress, history of depression, lack of social support system, unintended pregnancy, being on medicaid insurance, domestic abuse, low income or education, smoking, and single status or poor relationship. Postpartum depression has some of the same risk factors but also includes those related specifically to the birth experience and postpartum period. These include having a traumatic birth, preterm birth, infant requiring neonatal intensive care, difficulty breastfeeding, and experiencing other stressful events in the postpartum period⁵⁰.

VACCINATIONS

Vaccinations are often thought of as purely given in childhood with immune protection

offered thereafter. However, protection from some of these vaccines can wear off over time and require a booster to ensure sufficient titer levels⁵⁴. While live virus vaccines, including the MMR and chickenpox vaccines, are to be given prior to pregnancy, there are vaccines given specifically during pregnancy to help protect both the mother and baby. Frequent prenatal visits during pregnancy provide an opportunity for women to get these vaccines. The Tdap vaccine is recommended for all pregnant women to protect the fetus against whooping cough, a serious disease that can be life-threatening in infants. Undergoing vaccination for Tdap during pregnancy causes the body to create antibodies that will be passed on to the baby, ensuring early protection against the disease. Pregnant women are at higher risk of contracting the flu and becoming seriously ill, specifically during flu season, due to changes in the immune system and heart and lung function during pregnancy. Becoming sick with the flu also puts pregnant women at increased risk for certain pregnancy related complications, such as preterm labor and delivery. Therefore, all pregnant women are recommended to get the flu vaccine at the start of the flu season before flu activity increases⁵⁵.

POSTPARTUM AFTER ADVERSE PREGNANCY OUTCOMES

Pregnancy can be both physically and mentally straining on a woman's body, particularly in the case of an adverse pregnancy outcome. Common adverse pregnancy outcomes including gestational diabetes, hypertensive pregnancy disorders, and preterm delivery double a woman's risk of developing cardiovascular disease in the 10 years following birth⁵⁶. The first year following delivery is a critical time to identify increased health risk and intervene when necessary for multiple reasons. Patients are often still motivated during this postpartum window to make healthy lifestyle changes and develop healthier habits that they may have begun during

pregnancy⁵⁷. Second, women of reproductive age in the United States are a population who generally do not seek preventative health care at the recommended level, except during pregnancy⁵⁸, making pregnancy a gateway to primary care which should continue following birth. Third, adverse pregnancy outcomes commonly foreshadow the development of hypertension, obesity, and high cholesterol, which are traditional risk factors for cardiovascular disease⁵⁶.

Gestational Hypertensive Disorders

Women with a history of gestational hypertension are at increased risk of developing hypertension, cardiovascular disease, metabolic disease, cerebral disease, stroke, and renal disease later in life⁵⁹. Women who suffered from preeclampsia during pregnancy are three to four times more likely to develop high blood pressure later in life. It has not been determined whether the women were already predisposed or if the increased risk is caused by the preeclampsia itself, however, the first emergence tends to be in the years following pregnancy⁶⁰. Women who had hypertension in their first pregnancy are also at higher risk of developing hypertension in subsequent pregnancies, with the greatest risk being associated with earlier onset of high blood pressure in the first pregnancy. There is a 19% chance of recurrence for gestational hypertension and a 32% of recurrence for preeclampsia⁶¹.

Gestational Diabetes

Women diagnosed with gestational diabetes have a higher risk of developing glucose intolerance at some point following delivery, either in the form of gestational diabetes in a subsequent pregnancy or diabetes unrelated to pregnancy. There is a 41% chance that a woman who had gestational diabetes in her first pregnancy will develop the condition again in her

second pregnancy, and a 57% chance that a woman who had gestational diabetes in her first two pregnancies will develop the condition again in the third pregnancy. It is thought that maternal weight gain between pregnancies is associated with a higher risk of gestational diabetes recurrence. Approximately a third of women with diabetes had a pregnancy with gestational diabetes. A meta-analysis report concluded that women with gestational diabetes had a seven times higher risk of developing diabetes later in life compared to women who did not have gestational diabetes⁶².

Postpartum Depression

Postpartum depression commonly occurs within four to six weeks following childbirth, and is characterized by symptoms including depressed mood, anxiety, lack of energy, loss of interest in activities, disturbed sleep, changes in appetite, feelings of guilt and worthlessness, decreased concentration, irritability, and suicidal thoughts. Postpartum depression that goes untreated can have serious negative consequences for both the mother and baby. For the mother, untreated postpartum depression can lead to weight issues, use of alcohol and drugs, relationship struggles, challenges with breastfeeding, and dysthymia. The risks to children whose mothers had untreated postpartum depression include decreased cognitive function, behavioral inhibition, lack of proper emotional development, violent behavior, and psychiatric disorders in adolescence⁶³. Approximately one in seven women develop postpartum depression⁶⁴.

INTERVENTION

While pregnancy is an optimal time for women to improve their health, there are only a limited number of effective interventions available aimed at helping women implement a healthy lifestyle during pregnancy that includes a nutritious diet, exercise routine, and regular prenatal

visits to the doctor. However, multiple interventions directed at preventing alcohol consumption and smoking during pregnancy currently exist and have been in use for decades⁶⁵. Determining the factors that contribute to success and failure rates of interventions preventing alcohol consumption and smoking during pregnancy can be useful in creating effective interventions promoting healthy lifestyle changes and encouraging women to attend all prenatal doctor appointments.

PREVIOUS SUCCESSFUL EVIDENCE-BASED INTERVENTIONS

Alcohol Consumption During Pregnancy

The risks of consuming alcohol during pregnancy are well researched and documented⁶⁶, and it has been determined that no amount of alcohol is safe for the developing baby. Alcohol consumption during pregnancy puts the baby at risk for Fetal Alcohol Spectrum Disorders (FASDs), a group of potential diagnoses that are caused by exposure to alcohol in utero. These disorders include low body weight, coordination issues, hyperactive behavior, short attention span, poor memory, language disabilities, low IQ, decreased reasoning and judgment skills, issues with vision, hearing, the heart, kidneys, or bones, decreased height, small head size, and abnormal facial features⁶⁷. Binge drinking specifically is associated with cognitive problems and moderate drinking is associated with behavioral issues. Since 1991, the Centers for Disease Control and Prevention have been involved with interventions aimed at preventing FASDs by monitoring alcohol consumption among reproductive aged women, implementing alcohol screening in primary care clinics, and providing educational information on FASDs for women of reproductive age⁶⁵.

Since then, many alcohol interventions have been held in prenatal clinics, and more

recent studies have been done to analyze these interventions and determine what factors have been successful. Results from controlled trials indicate that brief interventions and motivational interviewing by obstetric care providers are effective at intervening with women who continue to drink during pregnancy. Research has further shown that media campaigns promoting discussing alcohol use in health care settings and educating the public about intervening with family members could be effective tools in the cessation of alcohol consumption during pregnancy⁶⁶.

A study done in 2007 on 255 pregnant women had very successful results using a brief intervention strategy, where women were five times more likely to report abstinence compared to women who were not part of the intervention. The effects were also seen in the health of the newborn babies born to the women who were part of the intervention group, with birth weights and lengths being higher and a three times lower mortality rate. Successful interventions included increasing awareness of potential consequences of alcohol consumption, support in formulating goals aimed at reducing drinking, and advice on identifying risky situations. It was found that these interventions do not need to be carried out by specialists knowledgeable in the treatment of alcohol abuse, but can be done at each visit to the obstetrician in just 10-15 minute sessions⁶⁸.

Smoking During Pregnancy

Smoking is proven to be extremely harmful to a developing fetus, largely raising the risks of the baby being born too small, premature birth, lung and brain damage, cleft palate and other birth defects, and Sudden Infant Death Syndrome (SIDS)⁶⁹. While the risks for smoking to pregnant women are well known, less than half of pregnant smokers report having been able to successfully quit during pregnancy⁷⁰, and this statistic is with the acknowledgement that

self-reporting likely leads to an overestimation in how many women actually quit⁷¹. Many interventions exist to assist pregnant women in quitting smoking, including counseling, self-help readings, nicotine replacement therapy (NRT), antidepressants, and pharmacologic cessation aids. Limited effectiveness for a majority of interventions has been concluded by systematic reviews, however, there have been some studies reported to have been successful⁷².

One meta-analysis study looked at 120 previous intervention trials to distinguish between effective and ineffective factors. Results indicated that psychosocial interventions increased the number of women who ceased smoking during late pregnancy by 35%, with these women seeing a 22% reduction in their babies requiring neonatal intensive care, and a 17% reduction in their babies being born with a low birth weight. Psychosocial interventions were defined in the study as non-pharmacological strategies that instead used cognitive-behavioral, supportive, and motivational therapies to assist women in quitting. Counseling, financial incentives, and feedback proved to be effective, while health education appeared to be borderline effective, and the effect of social support remained unclear⁷³.

CREATING INTERVENTIONS FOR FUTURE SUCCESS

As more research has been done in the past few years on the lifelong effects of maternal health, exercise, and diet on the fetus, pregnancy is increasingly looked at as the perfect opportunity for women to get their health on track. Since women frequently access healthcare services during this period, there are multiple opportunities for healthcare providers to implement interventions to assist women in the health improvement process⁵. It is important to understand that creating effective interventions is a challenging, expensive, and time consuming process that requires extensive knowledge and a nuanced understanding of the medical,

sociological, and psychological aspects of a person.

Interventions aimed at assisting women in ceasing smoking and alcohol consumption during pregnancy have been in use for decades, and many systematic reviews and meta-analyses have been published comparing the effectiveness of different trials. These studies can be used as a starting point to create effective interventions to help women develop healthier habits during pregnancy, including a nutritious diet, safe exercise routine, and regular visits to an obstetrician to be screened for diseases and receive recommended vaccinations. Preventing alcohol consumption and smoking during pregnancy has likely been the priority for all these years as severely detrimental effects on the fetus are widely known. Society does not seem as aware of how harmful an unhealthy maternal lifestyle can be to a developing fetus. Furthermore, if women are not getting the proper pregnancy screenings for mental health, gestational diabetes, hypertension, and sexually transmitted infections as well as vaccinations at the recommended times, they are also putting themselves and their babies at risk for adverse outcomes.

The first step to create interventions must be to educate women of reproductive age about these issues, the same way this population has been taught about the risks of smoking and alcohol consumption during pregnancy. This can be done through advertising and media campaigns, as was found to be effective in the case of alcohol consumption and pregnancy⁶⁶. However, these messages need to match what women are hearing from their healthcare team. One study regarding alcohol consumption during pregnancy demonstrated that while medical schools teach about the detrimental effects of alcohol, there is little to no training required in alcohol counseling. Researchers suggested that health care practitioners become well trained in giving practical advice and strategies during brief patient consultations⁶⁶. The same applies for

other areas of health improvements. Doctors should be knowledgeable and comfortable enough to inform women of the risks associated with an unhealthy lifestyle or irregular prenatal visits during pregnancy. They should be able to provide brief counseling to women to encourage healthier habits during this period. One of the most important discoveries from a meta-analysis done on smoking women during pregnancy was that counseling was proven to be effective at helping women quit smoking with no association of adverse effects⁷³. Researchers can use those studies as a starting point to see if the same is true for encouraging women to improve lifestyle habits.

Another intervention that was proven to be effective for women trying to quit smoking during pregnancy was a financial incentive⁷³. Further research should be done to see if the same would apply as an incentive for women to focus on diet, exercise, and attending regular prenatal visits. For women in a low socioeconomic category, this can be particularly effective, especially because healthy food and access to exercise equipment can both be extremely expensive. Attending regular doctor visits during pregnancy could also be a financial concern as it may mean missing work, traveling expenses, and copays.

An intervention that was successful in helping women lower alcohol consumption during pregnancy was providing women advice and support in formulating goals⁶⁸. Further research should be done to see if this can also be effective in promoting healthy habits. Women are already motivated to change their habits during the pregnancy period³, but even with motivation, it can be challenging to stick to new habits without proper goal setting. The research done on alcohol and pregnancy determined that goal setting sessions do not need to be led by specialists or professionals in the field and showed positive results even when done in just 10-15 minute

time intervals.

CONCLUSION

Pregnancy can be both an exciting and stressful time in a woman's life, with her body experiencing physiological, hormonal, and psychological changes. Maternal desire for a healthy pregnancy and healthy baby along with frequent access to healthcare during this period combine to make pregnancy the optimal time for women to focus on improving their health for the long term. While prior medical conditions can be exacerbated during pregnancy⁴ and new conditions are often diagnosed, women play an active role in keeping their bodies as healthy as possible for both their own futures and those of their offspring.

Much research has already been done to assist women in being actively healthy during pregnancy, specifically in the areas of cutting out alcohol and smoking during pregnancy. Less has been done on encouraging women to eat balanced, nutritious diets during pregnancy, to develop a proper exercise routine, and to attend all recommended prenatal visits. However, this is becoming a more researched topic especially as new scientific knowledge is coming to light regarding the effects of maternal health on the fetus and the ever growing field of epigenetics. Instead of starting over to create interventions for women in these areas, using the research done on preventing alcohol and smoking during pregnancy as a basis can be advantageous.

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