

Ergonomic Factors Associated with Pregnancy in a Laboratory Setting

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Dawn Gast

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In today's workforce, women account for more than half of the population comprising 59% of the total population of people that work.¹ As this number continues to increase, it becomes more important for companies to understand how pregnancy can influence the work environment. During pregnancy a woman's body is continuously changing. As she continues to grow, comes the rise in ergonomic risk factors that may affect the mother as well as the baby. An ergonomic risk factor involves any imbalance between the worker and the work environment, which results in extra demands on the worker. Specific ergonomic issues such as physical strain and exposure to chemical and biological hazards may affect women who work in a medical or research laboratory setting. Understanding what pregnancy does to the body and how it is affected by job tasks is the key to reducing the risks of injury and other health related concerns of working women.

Physiological Changes

During the course of pregnancy, the woman's body undergoes changes both physiologically and anatomically. The changes experienced are largely due to the hormones estrogen, progesterone, human chorionic gonadotropin (hCG), and human placental lactogen (hPL). "Hormones are chemicals that transfer information and instructions between cells in animals and plants. Often described as the body's chemical messengers, hormones regulate growth and development, control the function of various tissues, support reproductive functions, and regulate metabolism. Hormones are made by specialized glands or tissues that manufacture and secrete these chemicals as the body needs them."²

In the case of pregnancy, the ovaries and the placenta are responsible for making and releasing the hormones necessary for development. The hormone hCG prevents the release of eggs from the ovaries as well as stimulates the production of estrogen and progesterone. HPL stimulates the mammary glands in the breast to produce milk for use during breastfeeding. Estrogen and progesterone work to maintain a healthy pregnancy. Estrogen is responsible for the formation of female sexual characteristics. Progesterone stimulates thickening of the lining of the uterus to prepare for implantation of the egg.

From conception, where the sperm and the egg unite to form a zygote in the fallopian tube, hormone levels sky rocket as they assist in the development of what will become a fetus. The zygote, which is a cluster of cells, begins to rapidly divide as it travels in to the uterus. The cluster of cells form layers the outside of which will form a protective membrane for the embryo. Once reaching the uterus, cluster of cells attaches to the uterine wall where it will get nourishment. It is about this time that a positive pregnancy test can be observed. In addition to the physical changes occurring in the body, the emotional effects of discovering the news of pregnancy can be overwhelming.

At just 5 weeks from the uniting of the sperm and egg, the baby's heartbeat can be detected. The blood vessels form and grow, as the circulatory system becomes the first fully developed organ system. At around week 11, most of the vital organs have developed and are in place. The ears are beginning to be more distinct, the fingers and toes are fully separated, and eyelids are visible at this time.

¹ Bureau of Labor Statistics (2005)

² Microsoft Encarta (2005)

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Each week the fetus will increase by 30 times in weight up until it reaches 20 weeks. As a result, the blood vessels in the placenta are rapidly increasing to accommodate the baby's growing state.

It is in the first three months or so since conception that morning sickness begins to set in. The increasing levels of hormones are known to be the culprits to nausea and vomiting. It may be called "morning" sickness, but the queasiness you feel during pregnancy — especially during the first trimester — can hit at just about any time of the day or night.

To help ease nausea when you're on the job³:

- **Avoid nausea triggers.** Nausea can be heightened during pregnancy by certain food or smells. The food you typically consume when a woman is not pregnant or smells of certain food may cause her stomach to turn while she is pregnant. Once you identify things that trigger your nausea, do your best to steer clear of these odors.
- **Eat snacks and light meals.** Some foods such as crackers and other bland food can be helpful when a woman starts to feel nauseated. Snacking can be beneficial because it prevents the stomach from being empty or overfilled, which can increase nausea.
- **Drink plenty of fluids.** The body needs more water in early pregnancy. If a person doesn't drink enough fluid, nausea can become worse. A good goal is to consume at least eight 8-ounce glasses throughout the day.
- **Get enough sleep.** Tiredness can increase nausea. A pregnant woman should allow herself extra time in the morning to get ready for work to avoid rushing around — something else that can trigger nausea.

If severe, prolonged bouts of morning sickness are experienced, and simple measures don't help, it is important that the doctor be notified.

Even before conception there are important actions that need to be taken in order to reduce the risk of birth defects and support normal development. These healthy lifestyle choices include taking a multi-vitamin or a folic acid supplement. Lack of folic acid from the mother early on can lead to serious defects at birth. The presence of folic acid, or lack thereof, has been directly linked to miscarriages in the first 3 months of pregnancy. In addition it is important for a woman to exercise regularly, see a doctor for prenatal care, and manage any chronic or stress related health conditions.

During the second trimester, tissues that will become bone begin to form around the baby's head, arms, and legs. The mother begins to feel movements in the second trimester as the baby continues to grow and develop muscles. Around week sixteen the eyes have developed enough to be sensitive to light. Although they may not be able to open their eyes yet they can sense the changes in light.

³ Mayo Clinic (2005)

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Soon after, around week 18, the baby is sensitive to noise. It is at this time that nerve endings from the baby's brain are connected to the ears. Week 20 will mark the halfway point of a woman's pregnancy. At this time she has gained approximately 10 lbs for the average woman. She will continue to gain a pound per week for the duration of the pregnancy. At 27 weeks, the baby's length will have tripled or quadrupled since the 12-week mark.

The third trimester involves much growth as the baby begins to pack on the pounds. He or she will gain approximately $\frac{1}{2}$ a pound per week until week 37. Movements are felt strongly at this point since the growing baby has less room to move in the uterus. By week 37 a baby is considered full term and can be born healthy with little or no complications. As the due date approaches, the baby's organ systems continue to grow as they prepare to work on their own.

Blood Volume increases progressively from 6-8 weeks gestation (pregnancy) and reaches a maximum at approximately 32-34 weeks with little change thereafter. Most of the added volume of blood is accounted for by an increased capacity of the uterine, breast, renal, striated muscle and cutaneous vascular systems, with no evidence of circulatory overload in the healthy pregnant woman. Intake of supplemental iron and folic acid is necessary to restore hemoglobin levels to normal.. The increased blood volume serves two purposes. First, it facilitates maternal and fetal exchanges of respiratory gases, nutrients and metabolites. Second, it reduces the impact of maternal blood loss at delivery. Typical losses of 300-500 ml for vaginal births and 750-1000 ml for Caesarean sections are thus compensated with the so-called "autotransfusion" of blood from the contracting uterus.

Cardiac Output increases to a similar degree as the blood volume. During the first trimester cardiac output is 30-40% higher than in the non-pregnant state. Steady rises are shown on Doppler echocardiography, from an average of 6.7 liters/minute at 8-11 weeks to about 8.7 liters/minute flow at 36-39 weeks; they are due, primarily, to an increase in stroke volume (35%) and, to a lesser extent, to a more rapid heart rate (15%). There is a steady reduction in systemic vascular resistance (SVR), which contributes towards the hyperdynamic circulation observed in pregnancy.

Respiratory Tract. Hormonal changes to the mucosal vasculature of the respiratory tract lead to capillary engorgement and swelling of the lining in the nose, oropharynx, larynx, and trachea. Symptoms of nasal congestion, voice change and upper respiratory tract infection may prevail throughout gestation. These symptoms can be exacerbated by fluid overload or edema associated with pregnancy-induced hypertension (PIH) or pre-eclampsia. In such cases, manipulation of the airway can result in profuse bleeding from the nose. Airway resistance is reduced, probably due to the progesterone-mediated relaxation of the bronchial musculature.

Lung Volumes. Upward displacement by the uterus causes a 4 cm elevation of the diaphragm, but total lung capacity decreases only slightly because of compensatory increases in the transverse and antero-posterior diameters of the chest, as well as flaring of the ribs. These changes are brought about by hormonal effects that loosen ligaments. Despite the upward displacement, the diaphragm moves with greater excursions during breathing in the pregnant than in the non-pregnant state. In fact,

breathing is more diaphragmatic than thoracic during gestation, an advantage during supine (lying on the back) positioning.

From the middle of the second trimester, expiratory reserve volume, residual volume and functional residual volume are progressively decreased, by approximately 20% at term. Lung compliance is relatively unaffected, but chest wall compliance is reduced.

Anatomical Changes

During pregnancy the size of the uterus gradually increases and becomes more vulnerable to damage both by blunt and penetrating injury. From mid-pregnancy, the enlarged uterus compresses both the inferior vena cava and the lower aorta when the patient lies supine (on their back). Obstruction of the inferior vena cava reduces venous return to the heart leading to a fall in cardiac output towards the end of the term. In the unanaesthetised state, most women are capable of compensating for the resultant decrease in stroke volume by increasing systemic vascular resistance and heart rate. During anesthesia, however, these compensatory mechanisms are reduced or abolished so that significant hypotension may rapidly develop. Obstruction of the lower aorta and its branches causes diminished blood flow to kidneys, uteroplacental unit and lower extremities. During the last trimester, maternal kidney function is markedly lower in the supine than in the lateral position.

The fetus at first is well protected by the thick walled uterus and large amounts of amniotic fluid. During the third trimester of pregnancy the protective function diminishes and the fetus is more susceptible to trauma, because of increasing size, and less surrounding fluids. Relaxation of the pubic bones of 4-8 mm is normal during the last trimester of the pregnancy.

These changes brought about by pregnancy can have a great effect on the back. First, as the fetus grows, a woman's abdominal wall stretches to accommodate the expanding womb, and the extra room needed for this has to come from somewhere. Because the abdominal muscles are stretched far beyond their normal state during pregnancy, they lose their ability to perform their normal role in maintaining body posture and as a result, the lower back takes on an abnormal amount of weight from the torso.

The hormone relaxin is the second explanation for low back pain. During pregnancy, the hormone relaxin is present in 10 times its normal concentration in the female body. Relaxin is good in the sense that its function is to relax the joints in the pelvis so the baby has room to pass through the birth canal. Unfortunately, relaxin also causes abnormal motion in many other joints of the body, causing inflammation and pain. Fortunately, there are a couple of simple strategies that can help minimize the pain:

- Reduce your physical activities. If possible, minimize certain activities that maximally stress the lower back and pelvis. These activities include standing on

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one leg, climbing stairs, walking long distances and standing for long periods of time.

- Maximize vocational ergonomics. Take many short breaks, try to lie down, and educate yourself on structural fitness, i.e., body ergonomics, to avoid low back stress. Also, avoid lifting anything over several pounds.
- Strengthen your back muscles. You can strengthen the back muscles safely during pregnancy as long as there is no weight from the torso compressing the pelvis. There are three simple exercises you can try. "Prior to exercising, ask your doctor if he or she thinks these exercises are appropriate for you. Remember that the goal is not to become the next Miss Bodybuilder U.S.A., but rather to gently exercise your muscles to avoid lower back and pelvic pain."
 - **Exercise 1:** Get on your hands and knees as if you are going to scrub a floor. Lift your right arm up to the sky, so that it is level with your back, and at the same time, lift your left leg as high as you can, but no higher than the level of your hips. Hold this balancing posture for a second, without compressing your lower back. Do the same thing with the left arm and right leg. Keep alternating for 10 to 15 repetitions. This exercise helps strengthen the abdominal, shoulder and gluteal muscles.
 - **Exercise 2:** Get on your hands and knees again, aligning your wrists and your elbows under your shoulders and your knees under your hips. Inhale slowly and as you exhale, arch your back like a cat so that your body makes a convex C-shape. Hold the arch for a couple of seconds and repeat 10 to 15 times. This will help strengthen lower back and abdominal muscles.
 - **Exercise 3:** Lie on your back and perform mini-situps, keeping your knees bent to reduce the stress on your back. Lift your head and torso six inches from the ground and hold it for a second. Repeat this 10 to 15 times. This will help strengthen the lower back. Be careful not to pull up on your head as you lift, as this would strain your neck.
 - **Exercise 4:** This is the same as Exercise No. 3, but add a twist by drawing your right elbow toward your left knee, and vice versa, while lifting. This will help to strengthen the oblique muscles of the abdomen.

Use common sense when performing any exercise regimen. If you experience any abdominal discomfort or any other abnormal symptoms while performing the exercises, stop immediately and call your doctor. You should also call your doctor if you have any of the following problems:

- Severe pain: the mechanical pain of pregnancy should always resolve with rest.
- Pain radiating down the leg into the foot with weakness in the leg: This may be the sign of a herniated disc causing nerve compression. This does occur in rare cases during pregnancy and can be painful. Spinal surgery during pregnancy is possible, but with obvious risks"⁴.

⁴ Antoniadis, Spiro (2005)

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Knowledge and prevention are a woman's best ally during pregnancy, especially when experiencing pregnancy-induced back pain.

Avoid or Limit

- Physically Strenuous Work
- Work Requiring Balance
- Heavy Lifting
- Loud Noise
- Shift Work
- Long Working Hours
- Unadjustable Work Stations
- Prolonged Sitting
- Prolonged Standing
- Electromagnetic Field Exposure

Risks of Physical Injury

The pregnant worker is at her greatest risk for injuries during her third trimester when her abdomen is at its greatest size. Laboratory functions often times involve lifting of heavy items such as large volumes of solutions or other items in the area during work activities. The amount of stress on the lower back is greater when the object carried or lifted is further away from the lower back due

to the increased size of the abdomen (**see Figure 1**)⁵. The further away from the body the object is, the less weight that can be lifted. In Figure 2, a woman lifting a 4.5 kg (10 lb) object close to her body has about 29.5 kg (65 lbs) of pressure on her low back. The same woman lifts the same load when she is pregnant. Due to the larger stomach size, the object is lifted further away from her body. This causes about 68 kg (150 lbs) of stress on her low back when lifting the same amount of weight.

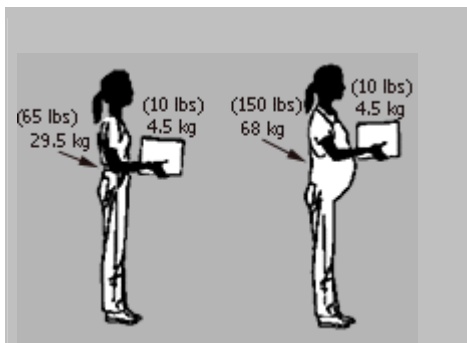


Figure 1:

This figure shows the amount of stress that occurs on the lower back increases when the object is lifted further away from the body.

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Generally, workers whose work is physically strenuous should be considered to be at increased risk when pregnant. Physically strenuous work includes prolonged standing for more than 3 hours per day, working on industrial machines, repetitive lifting more than 10 kg (22 lbs), assembly line jobs (repetitive work), and working in cold (such as walk-in freezers), hot, or noisy environments. Women in the third trimester should not perform jobs that require balance or lifting heavy weights. Exposure to loud noise, rotating shiftwork and long working hours should be avoided. The workstation should be adjustable to reduce any awkward postures and to accommodate the pregnant woman's changing body. Women in jobs where they sit a lot may develop low back pain which may be relieved with the use of a proper chair with a supporting lumbar back rest, as well as a foot rest. The work station should be adjustable so the woman may work either sitting or standing, to allow frequent change in posture. Walking should be encouraged throughout the pregnancy, but in moderation. Prolonged sitting or standing are leading risk factors for problems in pregnancy. Walking causes the leg veins to pump blood upward from the feet and helps prevent minor swelling of the ankles. Pressure from the firm edge of seat pans that can obstruct leg veins when sitting should be avoided because it may cause blood clots.

As pregnancy progresses, a woman must lift and maneuver objects farther from her body. This not only places strain on the lower back, but also on the arms and shoulders. Lifting loads farther from the spine is especially dangerous during this time because the woman's muscles and ligaments are already being stressed beyond normal levels. Pelvic muscles tend to relax and the joints of the spine become less stable, which only increases the risk of back injury. These risks occur most during the third trimester, when reach distance is greatest.

Balance The additional weight that a pregnant woman carries also affects balance. In a non-pregnant woman, the center of gravity is located just in front of the spine, level with the kidneys. During pregnancy, increased weight shifts the center of gravity forward, therefore affecting balance. Awkwardness, fatigue and the tendency to lose balance can become critical when working on elevated surfaces such as platforms or step stools.

Lifting Lifting may affect the pregnancy and fetus in several ways. Muscular activity typically alters blood flow in the body and heavy lifting can affect abdominal pressures, which may provoke uterine contractions. Additional body weight and increased reach distance also impact lifting tasks. When a pregnant employee bends over to pick up a box, she is not only lifting the box, but also extra body weight. Depending on the size of her abdomen will depend on how close to her body she can hold the object.

Pregnancy also changes the amount of weight an employee can lift safely. According to a study conducted by Texas University in 1988, that compared upper limb strength of pregnant and non-pregnant working women, non-pregnant women were found significantly stronger.

5 OHCOW (2005)

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The researchers of this study concluded that this finding could have safety implications for the mother and fetus and, therefore, should be considered when assigning jobs. The American Women's Association (AMWA) suggest that risk management programs include weight restrictions of 25 lbs. for pregnant women to lift. Standing The curve in the lower back progressively increases during pregnancy, which means the back muscles must work harder to help the woman maintain her balance. Consequently, after a pregnant woman stands for an extended period of time, she may experience lower back pain. Additionally, circulatory blood flow in the uterus and placenta decreases while a woman is in a standing position.

Repetitive Motion Approximately 28 percent of pregnant women experience Carpal Tunnel Syndrome (CTS). A major contributor of this is the extra fluid, which can culminate in the feet, legs, hands and wrists. This extra fluid can compress the median nerve in the wrist, producing CTS symptoms. Most health practitioners would attribute this development to pregnancy rather than work. However, tasks that require repetitive motions may increase the possibility of developing CTS. Fortunately, pregnancy-related CTS usually disappears after childbirth.

Companies can help curtail these injuries by establishing ergonomic programs and providing a comfortable, safe work environment for all employees. Laboratory workstations can be modified to suit the changes of a pregnant body. Each pregnancy is unique, so care must be taken to match job requirements to the individual's performance and capabilities. All aspects of the job should be assessed when considering modifications.

Handling Fatigue

Being pregnant, many women feel tired much of the time, especially during the first and third trimesters and even more so after a long day at work. Fatigue is the body's way of telling a person to slow down, but this can be tough during the workday. To make it through the day, try the following:

- **Take short, frequent breaks.** Regular rest periods can improve your productivity, especially if fatigue interferes with your ability to concentrate or make decisions. Getting up and moving around for a few minutes can reinvigorate you. Spending a few minutes during your lunch hour or break time with the lights off, your eyes closed and your feet up also can help you recharge.
- **Rethink your schedule.** Recognize that your energy level fluctuates throughout the workday. If you're exhausted by the afternoon, get your toughest or high-concentration tasks done earlier in the day. If it takes you longer to get charged up in the morning, put off energy-draining chores until the afternoon. If it's an option in your workplace, explore the possibility of flexible work hours to take advantage of the times during the day when your energy level is high.
- **Cut back on commitments and activities outside of work.** This can allow you to get more rest when your workday is over. If you have a physically demanding job, it's even more important to take it easy when you're not working.

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- **Be active when you can.** Although the last thing you may feel like doing at the end of a long day is exercising, it may help boost your energy level. Take a walk in the evenings after you get home from work or look into a prenatal fitness class — provided you have the OK from your doctor to do so.
- **Accept help from others.** During work hours, don't be too proud to accept help and support from your co-workers. After work, you may be used to cleaning your house, mowing the lawn and running errands. But to get in extra rest time, consider hiring services to do cleaning or yardwork. Also look into online shopping and home deliveries to gain extra time.
- **Go to bed at a reasonable hour.** If you're tired by 7 p.m., then turn in for the night.

Exposure to Chemicals During Pregnancy

“There are more than 4 million chemical mixtures in homes and businesses in this country, with little information on the effects of most of them during pregnancy”.⁶ However, a few are known to be harmful to an unborn baby. Most of these are found in the workplace, but certain environmental pollutants found in air and water, as well as chemicals used at home, may pose a risk during pregnancy. Laboratory technicians or other health-care workers may find themselves exposed to several hazards. These include infectious diseases such as herpes, CMV, and AIDS. Other risky exposures are to anesthetic gases and some cancer drugs, as well as chemicals used for sterilization and radiation. Most of these exposures are minor and usually cause no demonstrable problems, but minimizing exposure before and during pregnancy is certainly recommended.

In addition to normal safety precautions when working in a chemistry laboratory; there are a number of additional issues to be observed by pregnant women. Certain embryotoxins and teratogens are known to have adverse effects on the developing embryo. Embryotoxins are naturally produced chemicals that retard the growth, affect the development of specific functions the unborn child (embryo), or cause postnatal functional problems. In serious cases they can cause deformities or death. Teratogen refers to any agent that causes a structural abnormality following fetal exposure during pregnancy.

The influence of embryotoxins depends on the phase of growth the exposure took place. The greatest risk from embryotoxins occurs during the first 3 months of pregnancy, which includes a period when a woman may not know she is pregnant. The embryo is undergoing rapid growth and differentiation and significant malformations can be produced. The developing embryo depends on the environment to supply the substances needed for growth and differentiation of the tissues and organs of the embryo.

6 March of Dimes (2005)

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The result is that various chemicals, physical, and infectious agents may alter or arrest growth in the developing embryo. Although the development of the fetus is not as sensitive as the embryo, alterations may still occur throughout pregnancy, particularly in the nervous system.

Effects of Chemical Exposure

Currently extensive research has not been performed on the effects of many chemicals on the fetus. Therefore, it is especially important for women to take as many precautions as possible. OSHA has conducted some studies related to the intelligence and behavioral performance of the offspring of employees exposed to certain chemicals. For example, studies show that children of women exposed to common organic solvents during pregnancy have significantly lower scores on a wide range of cognitive, motor and behavioral tests. In recent years, scientists have realized that children are often much more vulnerable to the effects of chemicals than adults. But most workplace regulations set chemical safety standards by hazard to adults. Gideon Koren, a University of Toronto pediatrician and co-author, says findings showed that, as a class, solvents are more hazardous than previously understood: "Safety levels for adults are not necessarily safety levels for the developing brain."⁷ It is plain to see that more research is needed to understand the effects of laboratory chemicals on a pregnant woman and her child. As a precaution women who are pregnant should not be exposed to organic solvents during the duration of their pregnancy. Some examples of organic solvents include toluene, sodium azide, acetone, and dimethylsulfoxide

Quite a few jobs expose workers to teratogens, or chemical or physical agents that are harmful to a developing fetus. Health-care and laboratory jobs, hairdressing and cosmetology, housecleaning, laundry and dry cleaning, and factory work (including electronics, photography, textiles, and printing) may all expose you to potentially harmful chemicals or infectious agents. These substances can be inhaled, absorbed through the skin, or taken in by mouth. For most substances, there is an exposure level that will produce no detectable effect and a dose above which problems can occur. In some instances this "no effect" level of exposure is known; in others, it is not. In some cases, your exposure can be measured, such as when X-ray technicians wear exposure badges. Often, it can't be. It would be wise to evaluate the potential reproductive effect of any workplace exposures prior to trying to conceive.

There can be various risks associated with exposure to chemicals when working in a laboratory setting. Understanding your risks is essential to minimizing potential hazards. Pregnant women should consult the Material Safety Data Sheets for the products that are used in their workplace in order to be informed and avoid improper exposure to chemicals. If the MSDS's for chemicals is not available a women should consult her manager or supervisor or the Occupational Safety and Health Administration.

⁷ Kohn, David (2004)

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Accommodating Employees

More women are working outside the home than ever before. In most cases, a woman can plan to continue working through most of her pregnancy. That's not to say pregnancy won't affect her ability to work. She may feel extremely fatigued, especially in the early weeks, and she'll no doubt have to use the bathroom more frequently than usual. Morning sickness can certainly become an issue in performing daily workplace activities. The need to snack during the day may also be a factor in carrying out daily tasks. Increase in body size, back problems, swelling, and fatigue can make some jobs more difficult as pregnancy progresses. Arrangements need to be made for time to attend regular checkups. And if complications occur, a woman may have no choice but to discontinue work altogether.

A job requiring long hours is by itself not a risk factor in pregnancy. A study of physicians-in-training found that professional women who work long hours during pregnancy are just as likely to have healthy babies as other women who work more moderate hours. Researchers emphasize that these findings only apply to healthy women with no pregnancy complications, and that those women in the study who worked as long as 100 or more hours a week were more likely to have a pre-term delivery.⁸

Even before becoming pregnant, a woman should try to assess herself and her job realistically; that way, she'll know what to expect and how to plan ahead. As the pregnancy continues, she might have to reduce the number of hours worked each day. In fact, this is often better than reducing the number of days worked, since it's less fatiguing. Job modifications may be necessary since lifting, prolonged sitting, or standing may be difficult, as she gets further along. It is also important to know if the company's health insurance will continue for the duration of the pregnancy. Prenatal care is essential to monitoring the growth and health of the mother and baby.

In conclusion, pregnant employees require extra attention with respect to potential ergonomic hazards that either occur due to pregnancy or were there before pregnancy. Appropriate accommodations can prevent injuries, enhance the employee's comfort and help her better handle the stress of work combined with the physical changes related to pregnancy. A company can and should make efforts to accommodate their pregnant employees as they face these hurdles. The following actions can be considered when modifying a pregnant employee's job:

- Assign less physical tasks.
- Restrict lifting to 25 pounds.
- Vary tasks to avoid static posture.
- Install foot rests (for seated and standing workers) so that one foot can be alternately raised.
- Adjust height of work surfaces and chairs. Women late in pregnancy may prefer a lower table height than common guideline heights.
- Limit standing time to less than 3 hours a day.
- Modify break schedules (shorter, more frequent).
- Reduce amount of work performed at heights (such as on ladders or stepstools).

⁸ Herman & Perry (1997)

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