



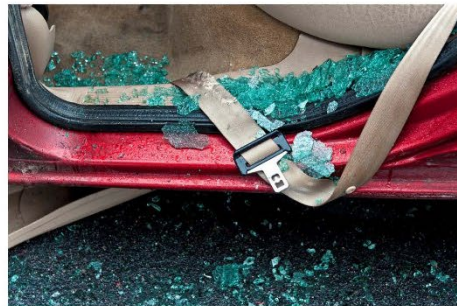
- My name is Greg Colton. I am the Community Outreach Captain for UCHealth EMS in Fort Collins, Colorado.
- We are going to talk about seat belt safety for pregnant vehicle occupants.
- Today we will just be scratching the surface of prenatal vehicle safety. If you would like to explore this topic in more depth, I have put together a report called *Seat Belt Use During Pregnancy: Improving Community Education* with a great deal more information and detail.
- If it helps you to take notes you are more than welcome to, but do not worry about trying to keep up or catch everything.
- The PDF of my slides and speaking notes is up on my website for you to download if you would like to. Jpeg copies of some of the graphics are on the website as well. And the report I mentioned is also on the website.
- The information for the website will be at the end of my presentation.
- I also have a booth in the exhibit hall if you would like to stop by.

Language and Terminology

“Pregnant Driver”



“Crash”



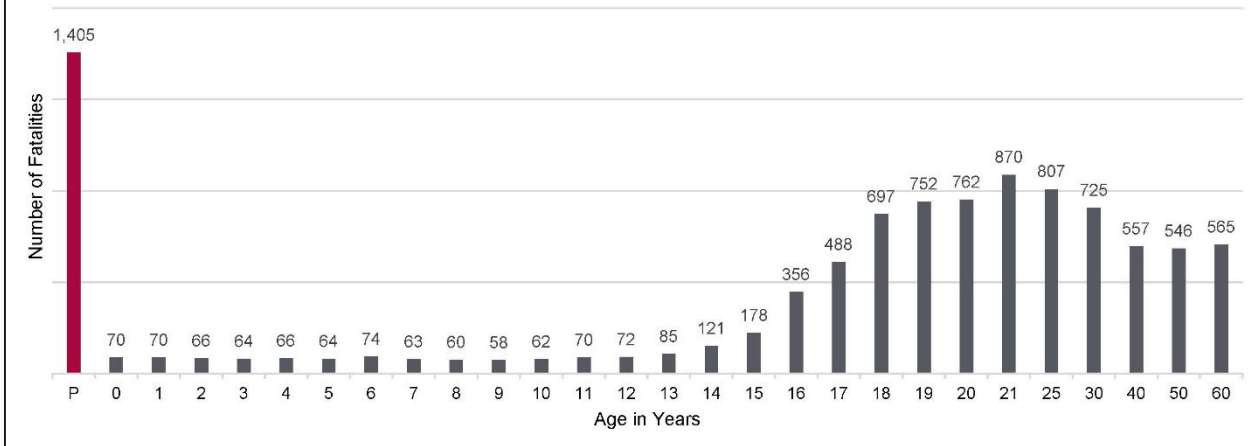
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- Before we dive in, we need to establish clear, concise, and consistent language.
- For this discussion we will use “pregnant driver” to refer to all pregnant vehicle occupants including all seating positions and all driving statuses.
- We will use “crash” to streamline terms like motor vehicle accident and road traffic collision.

- Alright, let’s get started.
- I have some bad news, some good news, a bit more bad news, then more good news.

Average MVC Fatalities 2017-2021 by Age



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- The first bad news.
- This is the average number of crash fatalities in the United States from 2017 to 2021 broken down by age.
- The gray bars are ages 0 through 60. As you can see it starts low, stays low, then increases, peaking at 21, then tapers off and levels off further into adulthood.
- The red bar is the estimated 1,405 fetal fatalities each year.
- As you can see, 1,405 is more than any other age in life.
- 1,405 is 20 times more than the average for 0-1 years old. That means that on this car ride this baby is at 20 times more risk of becoming a fatality than this one.
- Or if you want to phrase it in a slightly less gloomy way you can say that this baby is 20 times safer in the car than this one.

Other Negative Fetal Outcomes

Negative outcomes are not limited to fetal fatality.

- Fetal distress
- Premature rupture of membranes
- Premature birth
- Low birth weight
- Cesarean delivery
- Cerebral palsy



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- Unfortunately, the negative outcomes from crashes are not just limited to fetal losses.
- Crashes have been associated with fetal distress, premature rupture of membranes, premature birth, low birth weight, cesarean delivery, and cerebral palsy.

Mechanism of Injury



Placental abruption accounts for up to 70% of fetal losses.

- Can occur from many causes in a crash.
- Other causes of fetal loss:
 - Direct fetal injury
 - Uterine rupture
 - Maternal shock
 - Maternal death

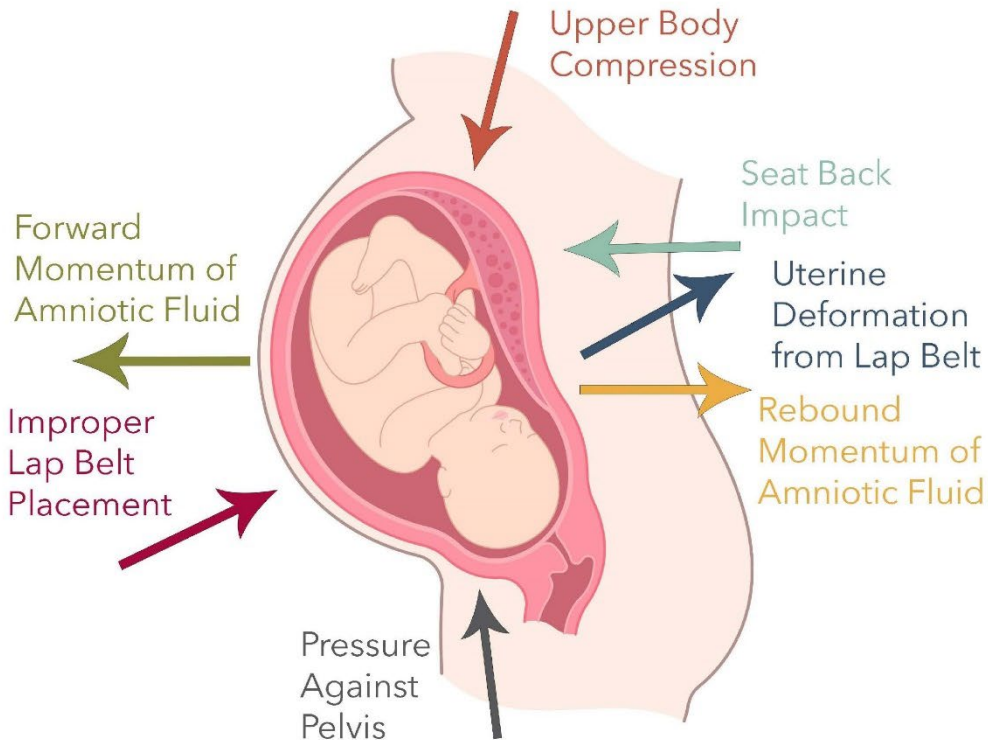
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- The foundation of preventing fetal loss is understanding the mechanism that causes it.
- And it is not necessarily what people think.
- When people think about fetal loss their mind typically goes to what is called direct fetal injury.
 - The lap belt presses on the abdomen. The baby's head is inside the abdomen. Pressure from the lap belt injures the baby's head.
 - Direct fetal injuries do happen, but they account for less than 10% of fetal losses.
- The uterus rupturing during a crash can happen as well and it is catastrophic, but it happens in less than 1% of cases.
- The pregnant driver losing blood and going into shock is a significant problem for both the driver and the fetus. And is the second leading cause for fetal loss.
 - Pregnant drivers can be more susceptible to internal organ injuries and bleeding than non-pregnant patients. It is also harder to recognize shock in a pregnant patient. And if they are in shock then the fetus has been without oxygen for a while.
- The majority of fetal losses are due to placental abruption.
 - Placental abruption is a medical condition where the placenta separates from the uterus, compromising the blood and nutrient flow to the fetus.

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Forces Acting on the Uterus During a Crash



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- Why is placental abruption the predominant cause of fetal loss?
- It can happen with or without external force on the abdomen.
- Any of these forces can lead to abruption and all of them occur in mere seconds during a crash.
- Placental abruption can also result from low-speed crashes and if the pregnant driver only sustained minor injuries.
- An abruption might also not be apparent until hours after the crash.

- If you like this graphic I made it is also on the website.

- Enough bad news for a minute.



Seat Belts Save Two Lives

Proper seat belt use can reduce adverse fetal outcomes by 84%

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- Now some good news.
- We can reduce the chances of fetal loss and these other negative outcomes by 84%.
- All it takes is simple proper seat belt use.

Evidence Indicates Seat Belts Help

1. A study of 25,168 pregnant drivers involved in MVCs in North Carolina found that unbelted women experienced a higher rate of adverse fetal outcomes, particularly fetal loss. (Adverse Pregnancy Outcomes Following Motor Vehicle Crashes - 2013)
2. A series of crash tests specifically designed to look at the area of placental abruption found that negative fetal outcome was not likely with a correctly positioned seat belt. (Severity of Placental Abruption in Restrained Pregnant Vehicle Drivers: Correct Seat Belt Use Confirmed by Finite Element Model Analysis - 2022)
3. An analysis of detailed crash reports in Michigan noted adverse fetal outcomes for 29% of properly belted subjects, 50% of improperly belted subjects, and 80% of unbelted subjects. (Fetal Outcome in Motor-Vehicle Crashes: Effects of Crash Characteristics and Maternal Restraint - 2008)
4. A study of 8,938 pregnant vehicle occupants in Utah found that unbelted occupants were 1.3 times more likely to have a low birthweight infant, twice as likely to experience excessive maternal bleeding, and 2.8 times more likely to experience a fetal loss than seat belted occupants. (Effect of Motor Vehicle Crashes on Adverse Fetal Outcomes - 2003)
5. The same study also concluded that pregnant vehicle occupants who were wearing a seat belt did not have a significantly higher risk of an adverse fetal outcome than a pregnant person who was not in a crash at all during their pregnancy. (Effect of Motor Vehicle Crashes on Adverse Fetal Outcomes - 2003)
6. A series of front- and rear-impact crash tests using a dummy designed to simulate a 30-week pregnant occupant found a 20% probability of adverse fetal outcome when the dummy was belted and a 60% probability of adverse fetal outcome when unbelted. (Effects of Seat Belts Worn by Pregnant Drivers During Low-Impact Collisions - 2010)
7. A review of Duke Trauma Registry patients found significantly higher rates of perinatal death among unbelted occupants. Additionally, it found that 73% of unbelted women complained of abdominal pain, versus 54% of belted women. And 25% of unbelted women required non-obstetric surgery following an MVC, compared to 7% of belted women. (Perinatal Implications of Motor Vehicle Accident Trauma During Pregnancy: Identifying Populations at Risk - 2013)
8. A study of 680 pregnant trauma patients from the National Trauma Data Bank found that unbelted pregnant patients were more severely injured, needed emergent surgery more frequently, and had longer hospital stays than belted pregnant patients. (Impact of Seat Belt Use in Pregnancy on Injuries and Outcomes After Motor Vehicle Collisions - 2020)
9. A series of crash simulations comparing unbelted, lap belt only, and lap and shoulder belt concluded that the lap and shoulder belt provided the greatest protection. (Analysis of Pregnant Occupant Crash Exposure and the Potential Effectiveness of Four-Point Seatbelts in Far Side Crashes - 2006)
10. The first crash tests completed with a specially designed pregnant crash test dummy recorded the lowest force and acceleration readings when the seat belt was worn in the recommended manner. (Automobile Crash Simulation with the First Pregnant Crash Test Dummy - 1996)
11. A review of 188 pregnant trauma patients at a level 1 trauma center found that every one of the maternal fatalities in the hospital's records were not wearing a seat belt at the time of the collision. (Consequences of High-Risk Behaviors: Trauma During Pregnancy - 2006)
12. Crash simulations using a highly detailed representation of a pregnant occupant and fetus to compare belted and unbelted occupants found that an unrestrained pregnant occupant had the highest uterine strain and risk of adverse fetal outcome. (Computational Model of the Pregnant Occupant: Predicting the Risk of Injury in Automobile Crashes - 2003)
13. A detailed review of 120 MVCs involving pregnant occupants found that almost all cases of direct fetal injury, uterine injury, or maternal death were not wearing a seat belt. (Injuries to Pregnant Occupants in Automotive Crashes - 1998)
14. A different review of case studies concluded that improperly restrained pregnant occupants have an increased risk of adverse fetal outcomes, even in low severity crashes. (Investigations of Crashes Involving Pregnant Occupants - 2000)
15. Using national data of pregnant occupants in MVCs, it was noted that 96.7% of seat belt-related injuries were categorized as minor injuries. Comparison of Pregnant and Non-Pregnant Occupant Crash and Injury Characteristics Based on National Crash Data (2014)

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- We have a lot of evidence that seat belts are helpful for pregnant drivers.
 - So much of it that I had to use size 8 font to fit it on a slide.
 - Don't worry about reading that. It's all in the report you can download from my website.
- Nearly 40% of pregnant drivers have some doubt that the seat belt will help them in a crash or actively think it could hurt their baby.
- We can rest assured that decades of data shows us that seat belts decrease negative patient outcomes.

Evidence Indicates Airbags Help

1. In a series of 30 cases at two major hospitals where a pregnant vehicle occupant was involved in an MVC with airbag deployment only one of the 30 patients experienced a fetal loss. Uterine Trauma in Pregnancy After Motor Vehicle Crashes with Airbag Deployment: A 30 Case Series (2006)
2. Another set of cases from a different hospital found that airbag deployment did not appear to increase risk to pregnancy. Computational Model of the Pregnant Occupant: Predicting the Risk of Injury in Automobile Crashes (2003)
3. A series of crash tests using dummies designed to simulate a pregnant occupant found that a three-point seat belt coupled with an airbag provided superior protection to the three-point belt alone. Computational Model of the Pregnant Occupant: Predicting the Risk of Injury in Automobile Crashes (2003)
4. A follow-up series of crash tests using computer simulations designed to recreate a pregnant occupant confirmed that a three-point seat belt paired with an airbag led to the lowest amounts of uterine strain recorded in the testing. Computational Model of the Pregnant Occupant: Predicting the Risk of Injury in Automobile Crashes (2003)
5. A study of 25,168 pregnant drivers involved in MVCs in North Carolina found that pregnant occupants in vehicles without airbags experienced higher rates of placental abruption and preterm birth than pregnant occupants in vehicles equipped with airbags. Adverse Pregnancy Outcomes Following Motor Vehicle Crashes. (2013)
6. Using national data of pregnant occupants in MVCs, it was noted that 98.9% of seat belt-related injuries were categorized as minor injuries. Additionally, 58.1% of the pregnant occupants who were injured by the airbag were unbelted at the time of the collision. Comparison of Pregnant and Non-Pregnant Occupant Crash and Injury Characteristics Based on National Crash Data (2014)



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- We also have a lot of evidence that airbags help pregnant drivers.
- It has not been studied as extensively so the slide is less impressive, but nonetheless we know that airbags help pregnant drivers.
- Airbags have gotten an unfair reputation.
- People say things like they contain a bomb and come at you at 200 miles per hour.
- It's an inflator, I have worked with bombs, and they are different, and the rapid deployment is more likely to save your life than severely injure you.
- If airbags were hurting people we would not be stuffing them into ever more creative corners of cars and even putting them in the patient compartment of our ambulances.

Incorrect Seat Belt Use Can Be Dangerous

- Risk of abruption increased 50 times in pregnant drivers with seat belt marks on their abdomen.
- Crash tests have shown placement of lap belt over belly multiplies force on fetus three to four times.
- Further crash tests found that uterine strain increased each time lap belt was moved higher on abdomen.
- Multiple case studies of fetal death due to improper belt placement.

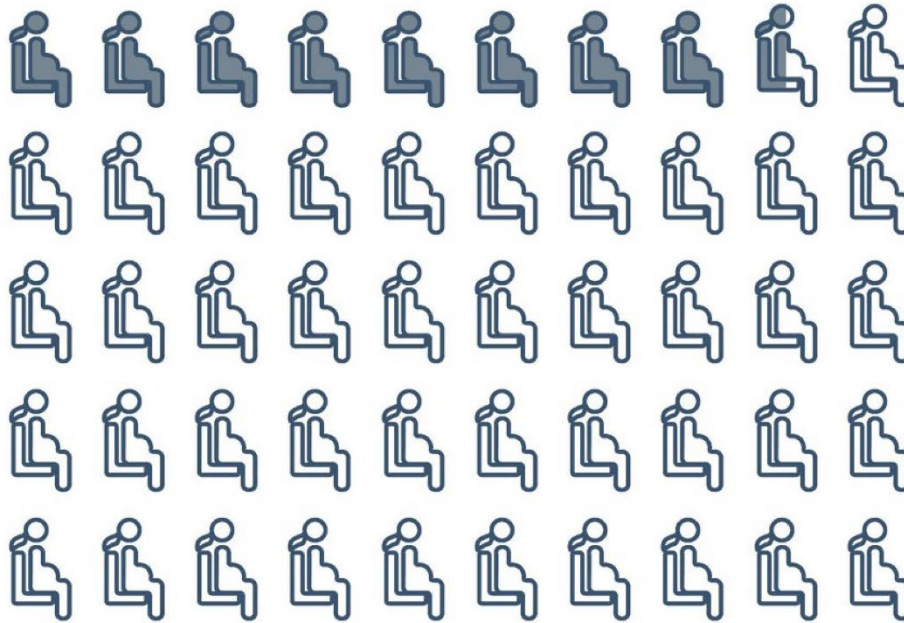


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- Unfortunately, we also have evidence that incorrect seat belt use can be dangerous for pregnant drivers and fetuses.
- Many specific findings point to improper lap belt placement being one of the most significant risk factors.
- That is not great because improper lap belt placement is the most common misuse we are seeing out in the field.
 - 60% of our initial check drivers have their lap belt on their belly, like this stock photo model here does.
- I want to be very clear. In the big picture seat belts help. You saw the size 8 font slide.
- This information does not make an argument against seat belt use or an argument for seat belt modifying products. This emphasizes the importance of proper seat belt use for pregnant drivers.
- So if correct use is so important, then the next question is how many pregnant drivers are wearing their seat belt correctly?

Only 17% of Pregnant Vehicle Occupants Wear Their Seat Belt Correctly



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- Only 17% of pregnant drivers wear their seat belt correctly.
- The rate of proper use is incredibly low.
- This can be improved though.
- Seat belt education has proven to be highly effective in increasing the rate of correct seat belt use.

Three Tier Approach to Seat Belt Education



1. Informational Materials



2. In-Person Seat Belt Education



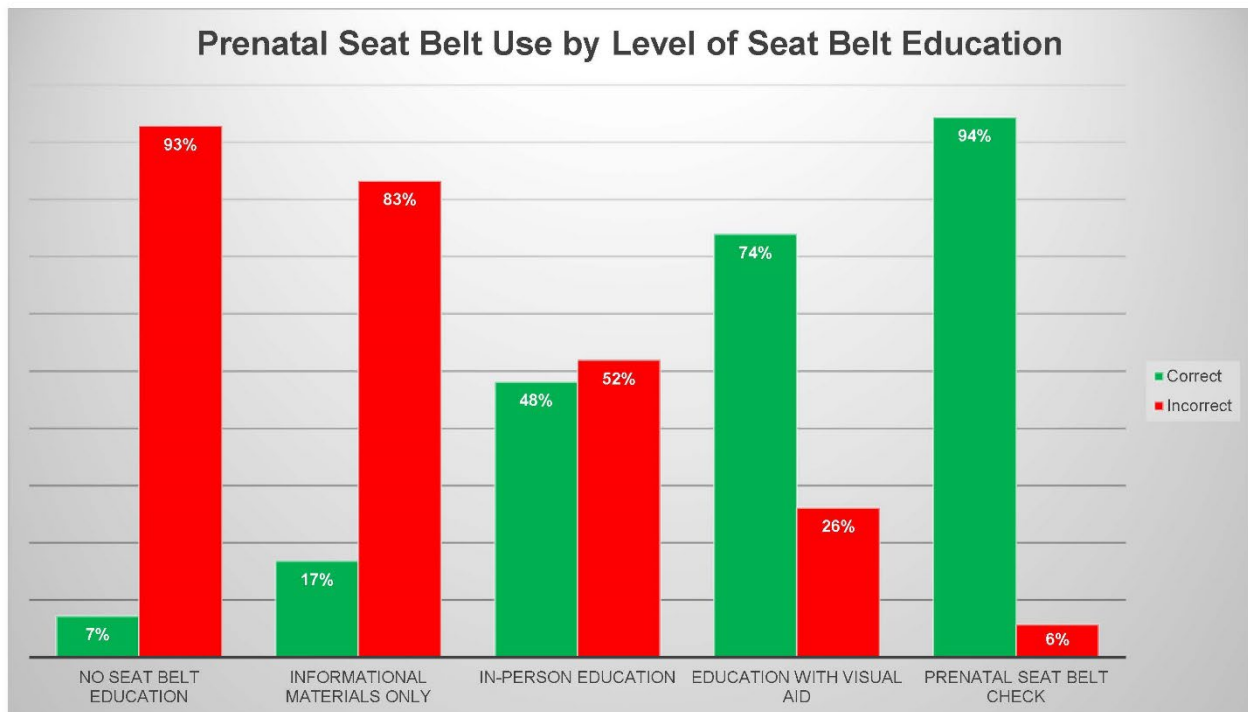
3. Prenatal Seat Belt Checks

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- We can take a three-tiered approach to seat belt education.
 - Informational materials like flyers, posters, and online.
 - In-person seat belt education at appointments or classes.
 - Prenatal seat belt checks for pregnant drivers similar to car seat checks for children.

Education Statistics



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- This is the rate of correct seat belt use broken down by level of seat belt education.
- As you can see, correct use increases tremendously with increased education.
 - A mere 7% correct use for drivers who did not receive any education.
 - A significant increase with just getting a flyer or seeing a poster, but still very low rate.
 - In-person education gives a huge boost to correct use.
 - Education where we could confirm the driver was taught with a quality visual aid finally brings us close to 100% correct use.
 - Receiving a prenatal seat belt check then coming back for a recheck has shown us that almost every pregnant driver still wore their belt correctly. Many of the six percent had errors that could not be corrected.
- We need to get all pregnant drivers as far up these tiers as possible.

Informational Materials – Flyers/Posters

Emergency Medical Services

Seat Belt Use During Pregnancy

Should I wear my seat belt?

- Yes. Wearing your seat belt properly is the most important thing you can do to keep you and your baby safe.

How should my seat belt fit?

- Place the lap belt under the curve of your belly so the belt rests on your hips.
- Wear the shoulder belt to the side of your belly and diagonally across the center of your chest and collar bone.

How should I adjust my seat?

- Sit back to provide space between your belly and the steering wheel, but be sure you can reach the pedals safely.
- Try not to recline the seat more than necessary. Sit in a comfortable upright position.

What should I do about my airbags?

- Tilt your steering wheel so the airbag is directed towards your chest, not your belly or your face.
- Adjust your seat to keep at least ten inches of space between the airbag and your chest.

What should I do if I am in a crash?

- Seek immediate medical attention and notify your prenatal care provider, even if you do not feel injured.

For more information, please visit www.hcpvs.org







IF YOU'RE PREGNANT SEAT BELT RECOMMENDATIONS FOR DRIVERS AND PASSENGERS


I'M PREGNANT. SHOULD I WEAR A SEAT BELT?

YES—doctors recommend it. Buckling up through all stages of your pregnancy is the **single most effective** action you can take to protect yourself and your unborn child in a crash.

NEVER drive or ride in a car without **buckling up first!**

WHAT'S THE RIGHT WAY TO WEAR MY SEAT BELT?


RIGHT



SHOULDER BELT
• Never from your neck (but not off your shoulder!)
• across your chest (between your breasts) to your hip/waist only.
• Slack from your waist belt.

LAP BELT
• centered below your belly so that it fits snugly across your hips and pelvic bone!

WRONG



SHOULDER BELT
NEVER!
• Never over your shoulder or back.

LAP BELT
NEVER!
• Never over on top of your belly.

SHOULD I ADJUST MY SEAT?


YES

ADJUST SEAT
• can recline, upright position.
• keep as much distance as possible between your belly and the steering wheel!
• reach to fully reach the steering wheel and pedals!

NO

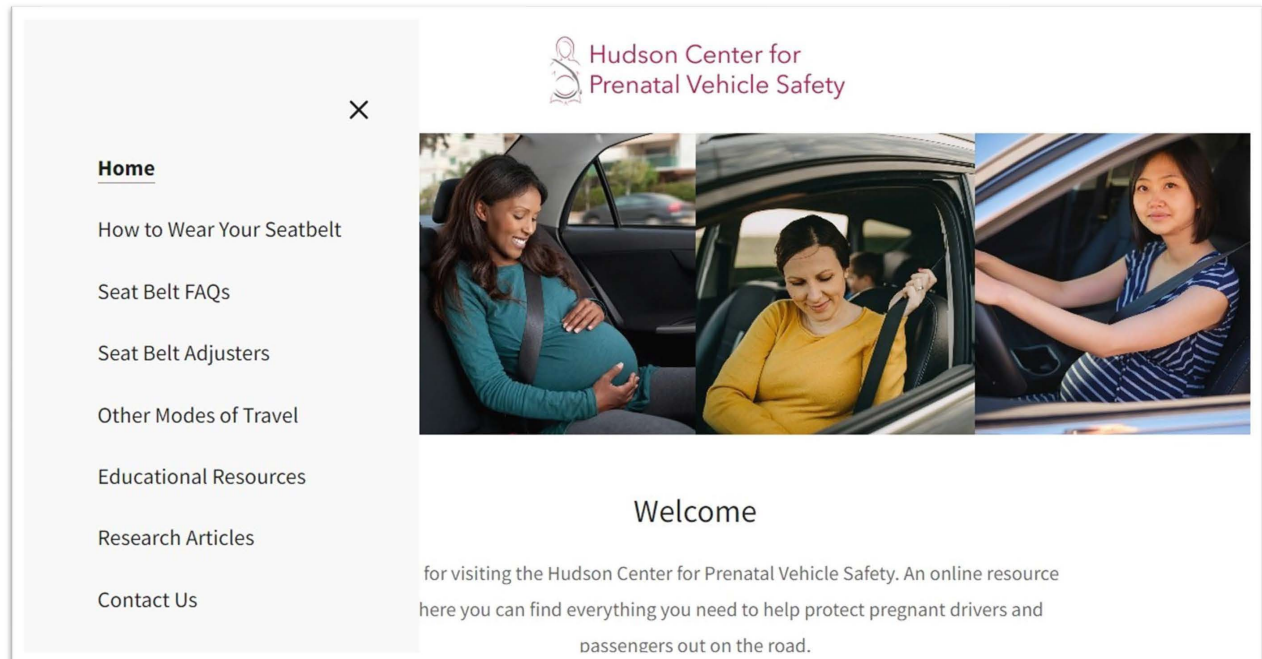
NEVER!
• Do not recline the seat back too far.
• Do not recline the seat back too far.
• Do not recline the seat back too far.

* If you need additional room, consider adjusting the steering wheel or having someone else drive, if possible.
** If you're a passenger, move your seat back as far as possible.



- Flyers are the easiest way to get seat belt information out to pregnant drivers.
- We put together a one sheet flyer that has all the information for the pregnant driver on one side along with the QR code for our website and pictures of a pregnant driver on the other.
- The flyer is currently available in 16 languages and can be customized with your organization's logo.
- NHTSA also has a nice flyer in English and Spanish.

Informational Materials – Website



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- To provide more information we put a website together.
- For pregnant drivers it has how to wear your seat belt, frequently asked questions, information about seat belt adjusters, and what to do on a plane, RV, etc.
- For professionals it has all of the downloadable resources and links to dozens of research articles on pregnant drivers and seat belts.

In-Person Seat Belt Education



In-person education is very impactful and easy.

- Only takes a couple of minutes.
- Can be given by anyone who interacts with pregnant drivers.
- Can be delivered individually or in a group environment.

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- In-person seat belt education is the most effective way for people without special training to increase traffic safety for pregnant drivers.
- It doesn't take much, just a couple of minutes.
- It can be done by anyone who interacts with pregnant drivers.
 - Providers, midwives, nurses, prenatal educators, car seat techs, fire, EMS, law enforcement, literally anyone.
- Education can be done individually like these two stock photo models are doing.
- It can also be done for a class or group.

Seat Belt Use During Pregnancy Teaching Tool

Seat Belt Use During Pregnancy



For more information, please visit www.hcpvs.org

Hudson Center for
Prenatal Vehicle Safety

Seat Belt Fit

- Place the lap belt all the way underneath the curve of your belly so the belt rests on your hips.
 - You may need to turn the lap belt over where it passes underneath your belly.
- Wear the shoulder belt to the side of your belly and diagonally across the center of your chest and collar bone.
- The shoulder belt should rest on your shoulder over the center of your collar bone.
 - You may need to adjust the recline of your seat or the height of where the shoulder belt comes out of the wall.

Vehicle Seat Adjustment

- Sit back to provide space between your belly and the steering wheel, but make sure you can reach the pedals safely.
- Try not to recline the seat more than necessary. Sit in a comfortable upright position.

Airbags

- Leave your airbags turned on.
- Tilt your steering wheel so the airbag is directed towards your chest, not your belly or your face.
- Adjust your seat to keep at least ten inches of space between the airbag and your chest.

Pregnancy Seat Belt Adjusters

- Pregnancy seat belt adjusters are not recommended.
 - For more information, visit www.hcpvs.org/seat-belt-adjusters.

For questions or more resources please visit www.hcpvs.org or contact Greg Cotton at Gregory.Cotton@uchealth.org

QR code for the Hudson Center for Prenatal Vehicle Safety website:

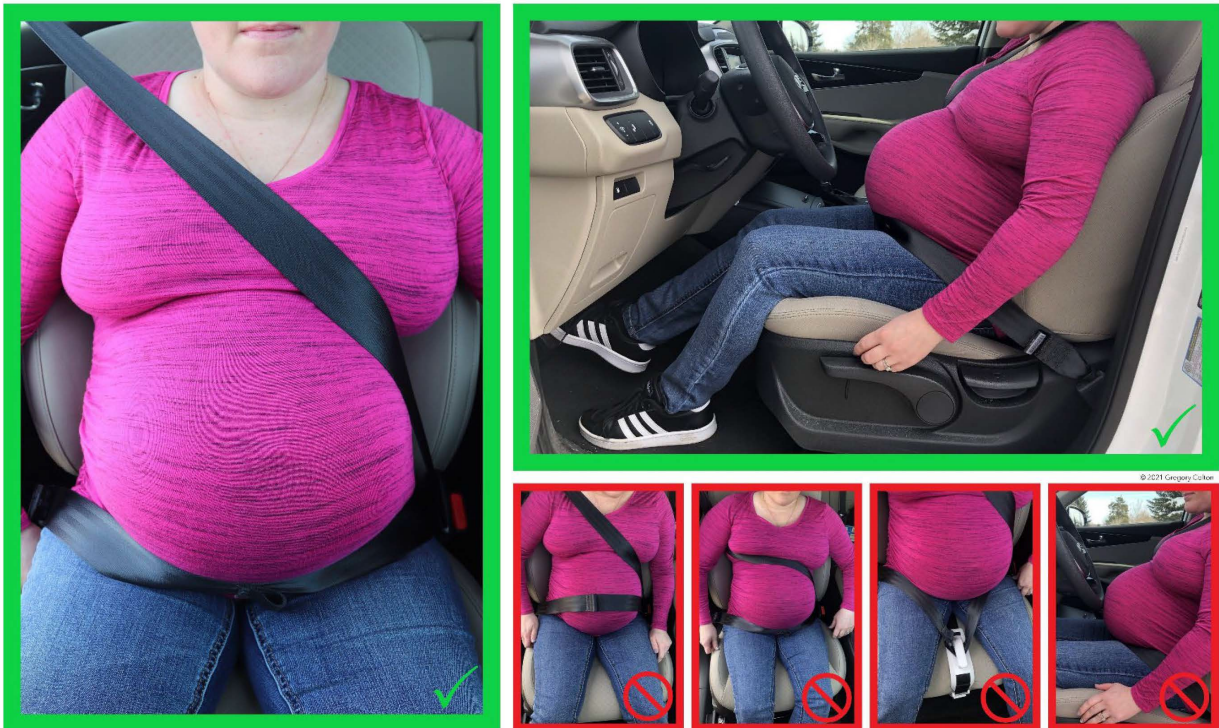


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- We put together a Seat Belt Use During Pregnancy Teaching Tool for people to use in educating pregnant drivers.
- It has what to do, what not to do, and on the back it has all the talking points for the person providing the education. My email and the QR code for the website are there too.
- Someone without any training on prenatal seat belt education can pick this up and teach a pregnant driver how to wear their belt.
- This can be downloaded on the website. I also brought over 700 laminated ones and have them at my booth in the exhibit hall.
- If you would some and can't fly them home I will mail them to you.

Seat Belt Use During Pregnancy



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- I would like to show you how fast this really is. This is my actual spiel:
 - Place the lap belt ALL the way under the curve of your belly so it is resting on your hips.
 - You may need to flip the lap belt over as it passes under your belly.
 - Wear the shoulder belt to the side of your belly and across the center of your chest and collar bone.
 - Adjust your seat so there is space between your belly and the steering wheel, but you can still safely reach the pedals.
 - Sit in a comfortable upright position. If you lean back a bunch it can increase the pressure of the lap belt on the underside of your belly, make it wander up your belly, and make a gap over your shoulder.
 - Leave your airbags turned on. Tilt your steering wheel so it's directed towards your chest, not your belly or your face. And you want to have at least ten inches of space between the center of the steering wheel and your chest so the airbag has time to inflate before you contact it.
- And there you go. This should be done at some point for every single pregnant driver. It is so easy. There is no reason not to do it.

Other Prenatal Seat Belt Education Tools



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- We have developed a number of other teaching tools for you.
- We partnered with Huggable Images to create a prenatal training doll to go along with their line of car seat dolls.
 - Disclaimer, I am not affiliated with Huggable Images and do not get anything if you purchase one.
- I am working on a three-point seat belt trainer that could be used on any chair and replaces the need for a dial-a-belt.
- There are other teaching tools as well.
- If you would like to check these out in person, I will have all of them at my booth.

Prenatal Seat Belt Checks

Seat belt checks are already done for other groups.

- Seat belt checks for children part of CPST curriculum.
- CarFit program for older drivers.

Pilot program has seen great results so far.

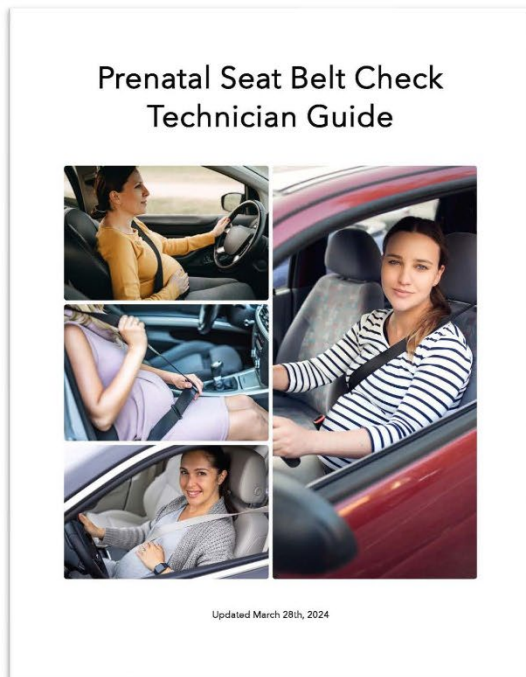


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- A prenatal seat belt check is our surest method for ensuring proper seat belt use.
- It is a bit more labor intensive though.
- This is not an entirely new concept. Seat belt checks for older children and adults have been around for years.
- Now we are just taking that process and tailoring it to pregnant drivers.

Seat Belt Check Tech Guide & Check Form



Prenatal Seat Belt Check Form v12.05.23

- Has your provider, prenatal class, etc. talked with you about how to wear your seat belt?
 Yes No Had a previous belt check
- Have you seen a flyer or poster about how to wear your seat belt while pregnant?
 Yes No
- How far along is the pregnant person?
 Weeks: _____
- How many fetuses are they carrying?
 1 2 Other: _____
- Is this the pregnant person's first child?
 Yes No
- How tall is the pregnant person?
 Inches: _____
- Vehicle Year: _____
 Make: _____
 Model: _____
- Pregnant Person Seating Position:

<input type="checkbox"/>	1st Row
<input type="checkbox"/>	2nd Row
<input type="checkbox"/>	3rd Row
- Lap Belt: (check all that apply)
 Correctly used
 Not under curve of belly
 Top edge close to or above belly button
 Seat recline affecting lap belt fit
 Using a pregnancy seat belt positioner
 Clothing/outwear affecting lap belt fit
 Other - See Notes
 Turned lap belt over for fit/placement
 Turned lap belt over for comfort
- Shoulder Belt: (check all that apply)
 Correctly used
 Low on B pillar
 High on B pillar
 Seat recline affecting shoulder belt fit
 Distance from dashboard affecting fit
 Clothing/outwear affecting belt fit
 Other - See Notes
 Increased seat height to improve belt fit
- Vehicle Seat: (check all that apply)
 Correctly used
 Reclined too far
 Too close to dashboard
 Too far from dashboard
 Seat height too low
 Seat height too high
 Other - See Notes
 Moved seat back to allow more space
- Steering Wheel: (check all that apply)
 Correctly used
 Less than 10" from airbag to chest
 Belly touching steering wheel
 Angled toward abdomen
 Angled toward face
 Other - See Notes
 Shortened steering column for space
 Not seated behind steering wheel
- Was the pregnant person correctly seat belted and properly positioned on arrival?
 Yes No
- Were all misuses corrected prior to departure? (If no, document)
 Yes No No Misuses Noted

Notes:

To Enter Check Data:
www.surveymonkey.com/r/prenatalbeltcheck



- We have developed a four-step process.
 - Lap belt
 - Shoulder belt
 - Vehicle seat
 - Steering wheel
- We also created a prenatal seat belt check tech guide and check form for CPSTs.
- If you are interested in offering prenatal seat belt checks please let me know and I can help you get that started.



Thank you for your time.

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- Thank you for your time.
- I really appreciate you coming to our panel today.
- There will be some time for questions and you can stop by my booth.

Greg Colton, UCHealth EMS
Gregory.Colton@uchealth.org



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- Here is my email address, please feel free to email me any time.
- And this is the QR code for my website.
- If you miss this, you can pick up a card with my info and the code at my booth.