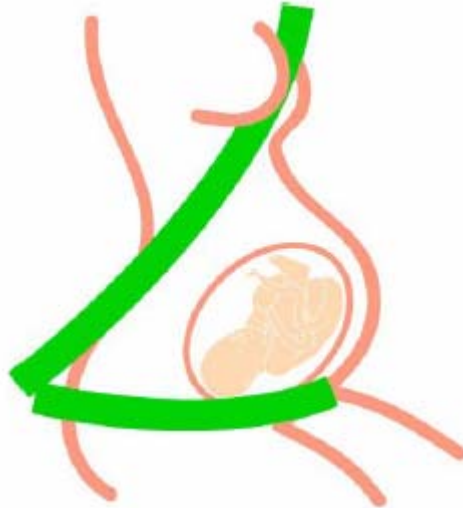


RACE REPORT



Pregnancy and Seat Belts

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1. INTRODUCTION

During pregnancy, most future mothers are particularly concerned about avoiding anything that may damage or harm the future baby at all costs. Food habits, those related to the consumption of stimulants such as nicotine, caffeine or alcohol or even physical exercise: any more or less daily activity that may be changed while it is necessary to “make a sacrifice and think only in what is best for the baby”. In a very different environment, airline companies strongly advise against air travel during the last months of gestation.

However, in relation to the car many pregnant women are unaware of the safest behaviour as drivers or passengers, particularly in terms of the seat belt and the real risks of not using this basic protection system, despite most of them being habitual users of private vehicles. This is due, in part, to the fact that most medical research carried out to date has focused more on how to treat subsequent injuries produced during pregnancy rather than how to prevent them or how to improve the design of vehicles and restraint systems in view of the peculiarities of pregnancy.

Despite all the maternal care and precautions, between ten and twenty percent of pregnancies do not go full term due to natural causes, mainly during the first weeks of gestation. In terms of miscarriages induced by traffic accidents, in the United States it is estimated that between 1,500 and 5,000 pregnancies fail as a result of vehicle collisions¹ and a similar level of values could easily correspond to Europe, although the lack of reliable data to this effect affects both continents. In the United Kingdom it is estimated that approximately 3% of women are involved in a traffic accident at some time during their pregnancy². In the United States this percentage amounts to 2%, a figure which is six times higher than that of children involved in car accidents³. It is also known that traffic accidents in that country are responsible for one in every three accidental deaths of pregnant women⁴. Moreover, traffic accidents are the main cause of miscarriages of traumatic origin in the US: the injuries complicate one in every twelve pregnancies and between 26 and 75% of said injuries are caused by traffic accidents^{5 6 7 8 9 10 11 12 13}.

In a proportional distribution of the population, traffic accidents may generate the miscarriage of between 200 and 700 pregnancies a year in Spain, without mentioning the number of non-fatal injuries or premature births. Although the lack of reliable information in our country may throw doubts on these figures, what is clear is that the number of miscarriages caused by traffic accidents may even be higher than the total figure of children who die in car crashes¹⁴. And miscarriages are not the end of it, as another type of complications associated to premature births may lead to permanent damage to the child. In any case, there is no doubt that during 2001 more than 400,000¹⁵ children were born in Spain, which means that over 400,000 pregnant women are vehicle drivers or passengers to a greater or lesser extent. If, as in the United Kingdom, three percent of Spanish pregnancies were involved in a traffic accident, we would be talking of 12,000 pregnancies exposed to these risks every year.

2. LEGISLATION CURRENTLY IN FORCE IN SPAIN

According to the General Traffic Regulation of 1992, particularly Section 119, pregnant women are exempt from the use of seat belts “when they have a doctor’s certificate in which their situation or condition as a pregnant woman and the approximate date of birth are indicated”. For its part, the European Directive 91/671 of 1991 only indicates that “the Member States may grant other exceptions such as those relating to specific physical conditions or individual circumstances of a limited duration”. In other words, the Directive permits, but does not impose, the exception that Spanish legislation includes in relation to the belt-pregnancy pairing.

The RACE Road Safety Department approves an improvement to the drafting of said legal text, firstly because with this draft the law seems to state **the importance of the certificate** and not the fact of being pregnant: if women have the certificate then they are exempt, although if they do not then they are not exempt. However, this criticism of forms is not as worrying as the one regarding its contents: there is currently no scientific evidence to support the idea that pregnant women travel more safely without using a seat belt, except in the cases for which there are specific medical reasons, which, on the other hand, are also applicable to any motor vehicle occupant.

Although it is true that at some stage some studies seemed to indicate that the seat belt or airbag could cause traumatic miscarriages^{16 17 18}, evidence in favour of the seat belt and airbag is overwhelmingly greater at present, as it will be shown in the following section. The studies “sceptical” of the effectiveness of restraint mechanisms during pregnancy are criticised mostly on account of their insufficient consideration of the collision’s violence when analysing injuries, although the seriousness of those collisions can be inferred from them in most cases, as the injuries to the foetus would have occurred anyway, regardless of the use or non-use of a seat belt. The following section will try to show that the Spanish legislation currently in force is not backed up by the great majority of research available at the moment.

3. EFFECTIVENESS OF SEAT BELTS DURING PREGNANCY

Over thirty years ago, a study from 1971 showed that “the mortality rate in pregnant women not wearing a seat belt is double that of those wearing one”¹⁹. In 1972, the American Medicine Association already recommended the seat belt use even during pregnancy²⁰. Twenty years later, in 1991, the American College of Obstetricians and Gynaecologists had prepared their advice as to the correct use of the seat belt during pregnancy²¹. The same advice for correct use was included in 1998 in a report prepared in the United Kingdom concerning maternal deaths⁴.

In a crash, three different collisions are caused. The first occurs between the car and the object against which it collides (which may be another vehicle, a tree alongside the road or the road surface itself in the case of the vehicle overturning, to name but a few examples). The second collision occurs a moment later when all of the occupants not wearing a seat belt are projected against the steering wheel, the dashboard, the windscreen or, in general, against the inside of the vehicle or the pavement if the bodies are ejected outside the vehicle. The seat belt holds in the occupants and enables them to progressively reduce their speed as the front of the vehicle is

deformed and absorbs the energy from the collision. In many occasions, this second collision is more dangerous for the occupants than the first: for those not using a seat belt, a crash between vehicles at only 50 kilometres an hour would be comparable to jumping from the top of a three-storey building. The work of the restraint systems is to avoid impact against the inside of the vehicle and to keep the occupants away from any element that may cause serious injuries. Lastly, the third collision occurs between the soft internal organs of the human body and the hard organs: for example, the impact of the brain against the skull, causing dazing or loss of memory, which are very common after a traffic accident. The seat belt also helps to notably reduce the violence of this third collision.

The understandable fear that seat belts exercise excessive pressure against the abdomen during a collision that damages the foetus or even causes a subsequent miscarriage has no scientific evidence to support it. "After several decades of research on the subject", as the American Traffic Authority clearly indicates, "it cannot be confirmed that the seat belt increases the risk of injury to the foetus, uterus or placenta in any type of collision, however violent it may be"²². Although it is true that the seat belt may increase the pressure on the amniotic sac at the time of impact, the foetus remains at most risk when the mother suffers injuries or dies and the seat belt clearly helps to prevent this possibility. **Mothers, before the foetus and thinking precisely of this, are the first who must be protected.**

The American researchers Crosby and Costiloe started research over thirty years ago into accidents with pregnant victims and concluded that the main cause of foetal loss is precisely the death of the mother¹⁹. The second cause of death indicated by these authors was the separation or abruption of the placenta. The first conclusion allowed the authors to confirm that "the best form of protecting the foetus is to protect the mother and the mother is best protected by the seat belt". Other authors such as Attico et al.^{†23}, Bowdler et al.²⁴, Drost et al.²⁵ or Herbert and Henderson²⁶ reached this same conclusion.

In 1972, Crosby also proved in a further study on pregnant women involved in traffic accidents that three-point seat belts (those with a lap or lower strap and a shoulder or upper strap) are safer than two-point seat belts (those with only a lap strap), although any seat belt is safer than none at all²⁷. Other researchers such as Esposito et al.²⁸, King et al.²⁹, Lane³⁰, Matthews³¹, Stafford et al.³², van Kirk and King³³ or Wiechel et al.³⁴.

In 1984, Renault also analysed the effectiveness of the seat belt on 49 pregnant occupants included in their accidents database: none of the pregnant occupants using a seat belt suffered serious injuries, whereas three occupants not using a seat belt and their foetuses died and another four women not wearing a seat belt were seriously injured³⁵. The nine pregnant casualties who died in Orange County, California, during a period of three years were studied in-depth by Agran et al. in 1986. All of them were occupants not using a seat belt, most of them drivers who seemingly impacted against the steering wheel during the collision³⁶.

In the last decade, the researcher DeSantis and her colleagues at the University of Michigan, after analysing 120 collisions with pregnant occupants in 1998, concluded

[†] Et al. = short form of "et alii", a Latin phrase frequently used in scientific references meaning "and others" in English.

that “although placental abruption may arise in occupants correctly secured by a seat belt, its non-use considerably increases the probability of placental separation and miscarriage”³⁷. In fact, the study included a total of 18 cases where no type of complication in the pregnancy arose, in 17 of which the women used a restraint system (three-point seat belt, airbag or both). The DeSantis study also showed that in the 24 cases with injury to the uterus, only five of the pregnant women included in the sample were using the three-point seat belt correctly. Moreover, in the four cases in which the lap strap was placed above the stomach, injuries to the uterus were caused. Furthermore, in most of the cases where the foetus was directly injured, the women did not use the seat belt. DeSantis also concluded that placental abruptions may also occur in slight collisions, while direct injury to the foetus normally occurs in violent impacts. DeSantis’ study is possibly the best study published to date on the subject and leaves the benefits of wearing a seat belt during pregnancy crystal clear.

DeSantis summarises the conclusions of her research, confirming that “most of the occupants not suffering injuries or complications in their pregnancy used the three-point seat belt, while only a small minority did not. Placental injuries and other types of complications are more frequent in those not using any restraint system. Lastly, injuries to the uterus occur more frequently in pregnant women using the seat belt incorrectly, i.e. those wearing the lap strap above the stomach”. A co-worker of DeSantis, Doctor Pearlman, also concluded in another scientific article published in 1999 that the two most reliable indicators on the possible loss of the foetus or other negative results on the pregnancy are the severity of the collision and the non-use of the seat belt³⁸. After analysing the injuries suffered by 43 pregnant occupants, Pearlman provided the following data in his studies: eight women were involved in collisions classed as severe, three of whom had been duly secured by the three-point seat belt and the other five not, and in all cases adverse consequences were produced for the mother and the foetus. Of the eleven pregnant women involved in moderate collisions, nine of them were using a three-point seat belt and one third suffered injuries or serious complications to their pregnancy, in comparison with half of the occupants not wearing a three-point seat belt. In collisions of lesser importance, only 8% of those wearing a seat belt suffered serious injuries or complications during pregnancy, in comparison with 33% in the case of not wearing a seat belt.

The following table shows the severity of the injuries suffered by the foetus in the forty-three cases analysed in detail by Pearlman in Michigan:

	Severity of the collision			Total	%
	High	Medium	Low		
With three-point seat belt					
Without serious injuries to the foetus	0	6	16	22	71%
With serious injuries to the foetus	4	3	2	9	29%
Without seat belt or with two-point seat belt					
Without serious injuries to the foetus	0	1	4	5	42%
With serious injuries to the foetus	4	1	2	7	58%
% of serious injuries to the foetus	100%	36%	16%		

Although probably unique thanks to in-depth research, the above data merely corroborate those of the previous study from 1993 in which approximately 2,600 cases of pregnant women involved in traffic accidents in the North American state of

Washington were analysed. The rate of premature children in women not wearing a seat belt was almost double the rate of those wearing one. Furthermore, the women not wearing a seat belt were 2.3 times more likely to give birth 48 hours after the traffic accident³⁹.

In relation to the most frequent types of injuries to pregnant occupants involved in traffic accidents, Pearlman already summarised them in his study in 1990⁴⁰:

Injury	Percentage of appearance
Placental abruption	Between 1 and 5% in the case of a slight accident and between 20 and 50% in the case of a serious accident
Rupture or laceration of the uterus	Less than 1% of all cases
Direct damage to the foetus	Less than 1% of all cases
Transplacental haemorrhage	Between 8 and 30% of all cases

If the above data did not suffice, this year another study has been published on 322,704 pregnant women, which has also been prepared in the United States between 1992 and 1999. This study by the University of Utah adds a new dimension to the methodology used so far as a control group of pregnant women that were not involved in traffic accidents is included in the sample. This study concludes that⁴¹:

- a) The risk of injuries to the foetus in the case of pregnant women suffering an accident while using the seat belt is not higher than the risk pregnant women are exposed to that are not involved in accidents[†].
- b) However, it is 1.3 times more likely for pregnant women not using the seat belt and suffering an accident to give birth before the end of term than it is for women who are not involved in accidents.
- c) On the other hand, pregnant women who do not wear the seat belt and suffer an accident are twice as more likely to suffer haemorrhages than pregnant women who use the seat belt and are also involved in accidents.
- d) Lastly, pregnant women not using the seat belt and suffering an accident are 2.8 times more likely to lose the foetus than pregnant women using the seat belt and also involved in accidents.

4. CONCLUSIONS OF THE UNIVERSITY OF MICHIGAN STUDY

The five conclusions of the University of Michigan study, surely the most extensive and thorough research work of recent years, speak volumes of the need to use a seat belt during pregnancy:

1. The basic form of protecting the foetus is to protect the mother by wearing a seat belt.
2. Although certain injuries to the placenta, the uterus or the foetus cannot be totally eliminated in pregnancies using the seat belt correctly, most injuries are produced in occupants not wearing a seat belt.

[†] The authors of this study admit that the cases of pregnant, non-driving occupants involved in traffic accidents can be included in the group of pregnant women.

3. The differentiating feature of the cases in which complications or injuries were not caused is the correct use of a seat belt by the mother.
4. All pregnant women suffering a car crash, even those considered insignificant, must immediately seek medical assistance. In most cases in which a miscarriage occurred, the mother either suffered minor injuries or showed no signs of other injuries apart from those suffered to the placenta, the uterus or the foetus.
5. The anatomy of pregnant women, particularly during the last stages of gestation, presents complications when travelling safely in a car, particularly in terms of positioning the lap strap correctly underneath the stomach and of the proximity of the pregnant woman to the airbag and steering wheel.

5. DRIVING AND PREGNANCY

There are two elements in cars that may exercise dangerous pressure on the stomach of pregnant women: the first is the lap strap of the seat belt and the second, only in the case of drivers, is the steering wheel. Although all experts agree that in most cases a minimum distance of 20 or 25 centimetres should be kept between the steering wheel and the thorax or abdomen, pregnant women may have many problems to meet this recommendation in vehicles with no steering and pedal adjustment, as many drivers cannot push the seat back and continue to comfortably operate the brake, accelerator and clutch pedals. The difficulties in achieving an ideal position are particularly obvious in occupants of a smaller stature.

Although the driving position may be adjusted appropriately at the start of gestation, in a study also carried out by the University of Michigan in the 90s on 32 pregnant women it was seen that women do not often change the position of the steering wheel or the position of the vehicle controls as the pregnancy progresses, despite the fact that the important changes in the anatomy of pregnant women normally require such modifications⁴².

As a result, the distance between the steering wheel and the mother's stomach is often notably reduced during the last months of gestation, even reaching the extreme case of the mother's stomach being practically in contact with the steering wheel. The distance between the steering wheel and the stomach decreases on average from 138.5 millimetres in the third month of pregnancy to merely 58.5 millimetres in the last month, according to the University of Michigan study mentioned above. Smaller occupants, those barely taller than one and a half metres, are on average at only 25 millimetres from the steering wheel (diameter of a two-euro coin). On the other hand, until around 20 weeks of gestation, the lower part of the wheel is often above the highest part of the uterus, thus the risk to the foetus and uterus until this point is not normally of concern. However, at the end of the pregnancy, more specifically at 36 weeks, the entire top quarter of the uterus is already above the lower part of the steering wheel, which presents an obvious risk, particularly for pregnant drivers not wearing a seat belt.

6. THE IMPORTANCE OF INFORMATION AND TRAINING

Many studies show that education and information increase the use of restraint systems during pregnancy⁴³ and that this *correct* use is much more frequent in women who have received information on the matter².

According to the survey carried out by Johnson and Pring in the year 2000 on 159 pregnant women, 98% of British expectant mothers wore a seat belt when sitting on the front seat but only 68% in the back². Unfortunately, less than half (48%) knew how to fasten a seat belt correctly. This was the situation in the year 2000 in the United Kingdom, considered one of the countries with the best safety culture in the world... The two most common reasons set forth in the English study for not wearing a seat belt in the back during pregnancy were: discomfort, on one hand, and fear of the belt damaging the foetus, on the other.

Of even more concern, other American studies also at the end of the last decade concluded that one out of every five pregnant women positioned the seat belt over their stomach on purpose, unaware of the risks involved¹⁴.

On this side of the ocean, the British doctors Pring and Jones at York Hospital insist that “the seat belt must be correctly fastened throughout the entire period of gestation to reduce the risks to both mother and foetus. It is equally vital that the information on how to correctly adjust the seat belt reach pregnant women at the start of gestation”².

7. OTHER LINES OF RESEARCH: DUMMIES AND COMPUTER MODELS

For years now, the family of dummies for vehicle crash testing includes a range from an adult of almost two metres in height to a small baby slightly over three kilograms in weight, with slender females measuring one metre and a half. However, to “make the family complete”, a dummy was required that represented a pregnant woman and, where possible, including the same level of detail in the foetus as in the adult occupant dummy. General Motors in the USA has remained true to its position as a leader in the field of crash tests – they developed the first dummy for the American government – and has developed the first pregnant dummy along with the University of Michigan, calling it the appropriate name of MAMA-2B (Maternal Anthropomorphic Measuring Appliance, Version 2B)⁴⁴.

In 1996, the team of engineers and doctors from Detroit presented the first dummy prototype and although its morphology and mechanical properties were not as realistic as had been hoped, it served to show its use for research^{45 46}. Although the second version of this dummy presented last year still lacks a placenta and foetus, it is now a very true representation of a pregnant woman after 30 weeks of gestation and has a sophisticated bank of sensors and data recorders installed inside the simulated, silicon-filled uterus: deformity of the top part of the uterus, in the area connected to the placenta and internal pressure on the front and rear of the abdomen. MAMA-2B is part of an ambitious multi-disciplinary research programme in which both doctors and engineers and reconstructors of traffic accidents are involved. The team led by Doctor Pearlman seeks to discover the connection between the pressure inside the amniotic sac and the risk of injuries to the foetus. As well as the

physical dummy, the group of researchers from Michigan also developed a computer model capable of measuring the forces generated in the abdomen under different types of conditions, particularly those supposedly related to placental separation. Among the studies prior to the development of the dummy, 43 real collisions involving pregnant passengers were studied, enabling a valuable amount of information to be accumulated as to how the anatomy of a woman evolves as the pregnancy progresses.

For its part, in the middle of last year the Swedish manufacturer Volvo announced that it also had a computer model of a pregnant woman with a high level of detail, with which important questions relating to the safety of mothers and the foetus may be solved⁴⁷, all without the need for expensive real tests thanks to (at least comparatively) economical computer simulations. In modern vehicles there are protection devices for all occupants, from the elderly to the smallest babies. For everyone except for the babies yet to be born. In fact, the scientific community is still in the dark in terms of discovering what happens inside the body of a pregnant woman. The Volvo model represents a woman in the last months of gestation, as it is then that the foetus is exposed to the greatest risk in the event of an accident. From the research centre located in Gothenburg, Camilla Parmertz, a biomechanical engineer at Volvo, indicated that “we have started to use the virtual pregnant dummy model in front impact simulations and one of its main advantages is that we can play with its size, making it larger or smaller to understand what happens to women of any height”⁴⁷. Among other things, the simulations allow for a better understanding of the effects of the seat belt and the airbag on the uterus, placenta and foetus, as well as the relative movement between the foetus and the mother’s body. At the end of the process, it will also be possible to optimise the design of the seat belt from the point of view of pregnant women.

Ford, Jaguar and Nissan in the United Kingdom, in collaboration with the manufacturer of restraint systems AutoLiv and the Motor Industry Research Association (MIRA), are also currently developing a specific seat belt for pregnant women⁴⁸. The project manager at the University of Loughborough, Dr. Serpil Acar, warns that “although there are laws and recommendations on the correct use of seat belts during pregnancy, the real situation is that the seat belt can be really uncomfortable for pregnant women and, therefore, they often choose not to wear it”. This three-year research project will help learn how pregnant women adapt to the changes in their bodies, allowing for a definition of characteristics of a seat belt suitable and comfortable for them.

8. ASSISTANCE SYSTEMS FOR ADJUSTING THE LOWER BELT STRAP

Although researchers and experts unanimously recognise the need to use a seat belt during pregnancy, they also insist that it must be used and adjusted correctly. The shoulder strap must be positioned between both breasts, while the lap strap must be as low as possible over the hips and never above the mother’s stomach. Although in certain situations this lower strap may tend to move upwards and away from its optimal position, even when it is correctly adjusted on the hips. In these cases a system that “pulls the lap strap slightly” downwards would help avoid unnecessary risks.

A recent survey by the University of Halmstad in Sweden and aimed at 139 pregnant women showed that despite all but one using the seat belt before pregnancy, during the last stages of gestation some admitted using it less often⁴⁷. The arguments given were: discomfort, fear of the seat belt harming the baby and difficulty in reaching and fastening the seat belt. Approximately half of the Swedish women in an advanced state of gestation had experienced problems when preventing the lap strap from moving upwards and resting on the stomach, away from its “safe” position. Similar problems were encountered to keep the seat belt ideally adjusted in another American study carried out on a sample of 200 pregnant women⁴⁹.

To help solve this problem, the Norwegian company HTS AS designed the “BeSafe Pregnant” seat belt adjustment system that can be purchased in Spain⁵⁰. According to indications by the SP Swedish National Testing and Research Institute, BeSafe does not decrease the effectiveness of the conventional seat belt⁵¹.

This system has started to become popular in our country, thanks, in part, to the information spread by specialised journals (Motor 16, Coche Actual⁵²) and in part to initiatives such as that of the car rental company Hertz which provides its customers with said seat belt adjustment system⁵³. With the slogan “Hertz protects what you love most”, this car rental company seeks to attract attention towards its efforts to look after its pregnant customers. Hertz provides its customers with the BeSafe Pregnant seat belt free of charge in six Spanish cities.

Without explicitly advising as to its use at present (and until greater experience of real collisions and the results of tests from laboratories with the second generation of pregnant dummies currently being developed are available), the RACE Road Safety Department highlights the following points:

1. Seat belts save many lives of mothers and foetuses.
2. For maximum seat belt effectiveness, its lower strap must not be above the stomach but underneath it.
3. Even when the seat belt is correctly adjusted on the hips, the uterus may get compressed by the lower belt strap, especially in the last stages of gestation⁴².
4. BeSafe helps place the seat belt underneath the stomach, i.e. in its correct position and may be more comfortable for mothers during pregnancy, thus fostering seat belt use.
5. The Swedish research centre SP has found that the BeSafe accessory does not hinder the effectiveness of seat belts in any way.

9. RACE ADVICE ON PREGNANCY AND CARS

An engineer would express himself by saying that the human body is “designed to move safely at a maximum speed of 20 km/h. If we want to go faster without reducing safety, precautions must be taken and we must protect ourselves.” The bodywork of the vehicle and the seat belt or the resistant clothing and helmet in the case of motorcyclists carry out this protective function. Similarly, the foetus travels inside its mother’s stomach, reasonably protected for a paused movement on foot but, as an adult requires additional measures when moving at a greater speed, the foetus must be duly protected together with its mother. RACE’s protection advice in the case of pregnant women is as follows:

- Wear the three-point seat belt (with a lap and shoulder strap) on all trips, except where expressly advised against by the gynaecologist.
- In the case of the seat belt being advised against by this specialist doctor, calmly reflect on the suitability of travelling by motor vehicle and, in any case, restrict it as much as possible.
- Wear the two-point seat belt (the belt with a single lap strap) only where wearing a three-point seat belt is not possible. The two-point seat belt is still very common for the rear central seat in many vehicles. The first studies carried out on chimpanzees in the US in the early 70s showed that the three-point seat belt divides the risk of fatal damage to the foetus by six⁵⁴. Another North American study in 1968 also reached the conclusion that the probability of losing the foetus when using a two-point seat belt is over five times that when using a three-point seat belt⁵⁵.
- Also wear the seat belt in the rear seat.
- Also wear a seat belt on buses and coaches, where available.

As to the correct adjustment of the seat belt during pregnancy, RACE’s advice is as follows:

- Adjust the lower lap strap to be as low as possible and snug to the pelvis, never above the stomach.
- Place the upper shoulder strap between the breasts and over the sternum, preventing it from being above only one. The ideal adjustment should pass the shoulder strap over the middle of the sternum and the centre of the collar bone. The lower part of this upper shoulder strap must pass to one side of the stomach and not over it.
- Most vehicles incorporate a belt height adjustment system (in some vehicles it is automatic) which is usually attached to one of the side pillars and always close to the shoulder. This mechanism can significantly help position the upper belt strap correctly.
- Never wear the upper or shoulder strap of the seat belt behind your back and never underneath your arm or armpit.
- Do not sit on the lower lap strap in order to use the upper shoulder strap only.
- Remove any looseness of the seat belt where possible. Do not put pillows or bolsters on the seat, between the latter and the shoulder.
- All adjustments, including that of the steering wheel and of the seat, must be changed whenever necessary as the pregnancy progresses.

- When purchasing a vehicle, consider those whose steering wheel and pedals may be adjusted, which significantly improves the driving position of smaller drivers.

Although the number of cases included in scientific literature is limited as yet, the seat belt-airbag combination seems to offer pregnant occupants some advantages as well as compared to the three-point seat belt alone without airbag⁵⁶. In this respect, RACE's recommendations are as follows:

- Sit as far away as possible from the front airbag, moving the seat backwards as much as possible. In any case, a distance of at least 25 centimetres between the chest and the steering wheel must be ensured to avoid impact against it or against the airbag as it blows up.
- If the steering wheel can be adjusted, redirect it towards your head and chest, avoiding it being completely facing your stomach.
- Except where advised by a doctor, there are not normally reasons to justify disconnecting the airbag.

Further advice on equally important issues during pregnancy is as follows:

- During the last stages of pregnancy, when the tummy is more prominent and it is truly difficult to maintain a minimum distance between it and the lower part of the steering wheel, the possibility of using a voluntary driver must also be considered, abandoning the driver's seat and occupying one of the passenger seats.
- It is difficult to indicate when it is "safe" to drive again after giving birth (it is normally indicated that not before one to three weeks after an uncomplicated birth and not before six weeks after a caesarean birth) and the best recommendation is to always take the advice of your gynaecologist.
- Despite the collision being apparently insignificant, the obstetrician must be informed as soon as possible in order to rule out any kind of complication in the normal development of the foetus⁵⁷.

Lastly, remember the completely valid maxim that says that although there are always rare exceptions, "any protection element is better than none at all" and although the restraint systems, if used incorrectly, may also cause certain injuries, the damage caused when these systems are not used is much more serious in the immense majority of cases.

10. INTERESTING DATA...

- ✓ The uterus is a muscular organ that multiplies its normal volume by 1,000 at the end of pregnancy, from 5 millilitres to over 5 litres.
- ✓ The greatest risk of death of the foetus during a traffic accident is the death of the mother.
- ✓ The most frequent injury suffered by the foetus is the lack of oxygen caused by placental abruption. The second most frequent is caused when the head of the foetus impacts against the mother's pelvis.
- ✓ Sweden is currently considered one of the safest countries in the world, although the use of seat belts in the front seats was made compulsory there in 1975, one year later than in Spain.
- ✓ The placenta is a highly vascularised organ that plays the role of "advanced circulation support" of the foetus, exchanging nutrients, oxygen and waste between it and its mother. During the last quarter of gestation, it has a thickness of approximately 2 centimetres and covers a quarter of the upper internal surface area of the uterus to which it is attached by countless tiny hairs with a diameter twenty times less than one millimetre.
- ✓ The probability of premature placental abruption, including any placental separation before birth, is around 1 in every 150 births. The traumatic injuries cause less than 5% of all placental abruptions, although these appear in between one and five percent of slight traffic accidents and between twenty and fifty percent of all serious accidents.
- ✓ The foetus is normally well protected by the pelvic bones until the end of the first quarter, when the "tummy" begins to be more ostensible and vulnerable to impacts.

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Studies show that the three-point seat belt (with a shoulder and a lap strap) is much safer than a two-point belt (only lap strap). In any case, any seat belt is safer than none at all, as protection of the mother is vital for the survival of the fetus. The lower or lap strap must be placed underneath the “tummy” and adjusted tightly over the hips. The diagonal or shoulder strap must be placed over the collar bone between the breasts and around the tummy. Neither strap must be placed on top of the tummy.