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## Choosing a safety seat for transporting a child - survey research

## Wybór fotelika bezpieczeństwa do transportu dziecka - badania ankietowe

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**Abstract.** The greatest threat to the safety and health of a child placed in a safety seat is still the incorrectly chosen and installed seat in the vehicle. Safety seats are considered the primary means of reducing the risk of injury in a road accident. However, most parents use improperly installed seats. Improperly chosen and installed safety seats can pose a risk of injury to children in the event of an accident. The aim of the article is to improve the safety of children transported in safety seats by identifying and determining the impact of various, often non-obvious factors on the choice of safety seat made by parents/legal guardians of the child. To achieve this, a survey was conducted among a group of 950 individuals to understand the behaviors of parents and legal guardians related to the purchase of safety seats. Respondents were tasked with answering questions related to travel time, seat attachment location, or their personal preferences related to place of residence or age. It is worth noting that as many as 357 respondents would definitely not repurchase their current safety seat. Additionally, the level of safety of the seat determined by crash test results is an important purchasing argument for 21.88% of surveyed women and 35.66% of surveyed men.  
**Keywords:** Safety seats; child safety; transport of children; travel behaviour; road safety

**Abstrakt.** Największym zagrożeniem dla bezpieczeństwa życia i zdrowia dziecka umieszczonego w foteliku bezpieczeństwa jest w dalszym ciągu źle dobrany i zamontowany fotelik w pojeździe. Foteliki bezpieczeństwa są uważane za główny sposób na zmniejszenie ryzyka obrażeń podczas zdarzenia drogowego. Mimo to, większość rodziców używa nieprawidłowo zainstalowanych fotelików. Nieprawidłowo dobrane i zamontowane foteliki bezpieczeństwa mogą stwarzać ryzyko obrażeń u dzieci w razie wypadku. Celem

artykułu jest poprawa bezpieczeństwa dzieci przewożonych w fotelikach przez identyfikację i określenie wpływu różnych, często nieoczywistych czynników na wybór fotelika bezpieczeństwa dokonywany przez rodziców/opiekunów prawnych dziecka. W tym celu przeprowadzono ankietę na grupie 950 osób, aby poznać zachowania rodziców i opiekunów prawnych związane z zakupem fotelika bezpieczeństwa. Ankietyowani mieli za zadanie odpowiedzieć na pytania związane z czasem podróży, miejscem mocowania fotelika czy dotyczących ich osobistych preferencji związanych z miejscem zamieszkania czy wiekiem. Warto zaznaczyć, że aż 357 respondentów zdecydowanie nie kupiłoby ponownie posiadanego fotelika bezpieczeństwa. Ponadto poziom bezpieczeństwa fotelika określony wynikami z testów zderzeniowych jest ważnym argumentem zakupu dla 21,88% ankietyowanych kobiet i 35,66% ankietyowanych mężczyzn. **Słowa kluczowe:** foteliki bezpieczeństwa, bezpieczeństwo dzieci, przewóz dzieci, zachowania podróżnicze, bezpieczeństwo ruchu drogowego

## Introduction

Safety seats are designed to safely and comfortably transport younger children from point A to point B. Car seats, seat belts and passive safety features such as airbags are designed with adults in mind. From an ergonomic as well as safety perspective, safety seats are needed to provide children with the same level of safety as adults, and often to improve it (Penmetsa, Adanu, Lidbe, Li, Nambisan, Jones, 2023; Zhang, Gao, Tu, 2023). Safety seats are made from a combination of durable materials, impact-absorbing foams, and comfortable, skin-friendly fabrics, usually attached to a sturdy frame (Champahom, Jomnonkwao, Thotongkam, Jongkol, Rodpon, Ratanavaraha, 2023; Jiang, Zhao, Lin, Yang, 2023; Brown, Elkington, Hunter, Charlton, Bilston, Hayen, Keay, 2020).

Choosing the right car seat for your child may initially seem complicated due to the simultaneous existence of various qualification systems. The first of these is based on mass and is defined in the R44 regulations. Size groups are defined the mass of the child. Thanks to this, it is possible to choose the right seat for your child. Some safety seats are designed to cover multiple groups. We distinguish the following groups (Posuniak, Jaśkiewicz, Kowalski, Dąbrowski, 2018; Domenech, Parera, Maturana, 2018):

- 0 to 10 kg – children from 6 to 9 months
- 0+ to 13 kg – children from 12 to 15 months
- 0+ and 1 to 18 kg – children up to 4 years old
- 1 from 9 to 18 kg – children from 9 months to 4 years
- 1 and 2 from 9 to 25 kg – children from 9 months to 6 years
- 2 from 15 to 25 kg – children from 4 to 6 years
- 1, 2 and 3 from 9 to 36 kg – children from 9 months to 6 years
- 2 and 3 from 15 to 36 kg – children from 4 to 12 years old.

Another group are i-Size safety seats. The seats comply with the EU safety regulations R129 (they will eventually be used for all new safety seats sold from 2023 onwards). However, this does not mean that R44-compliant safety seats will soon become obsolete. i-Size safety seats have several significant equalities. One of

these differences is the choice of seat based on the child's height. Another significant difference of i-Size safety seats is that children are rear-facing for longer (Xuerong, Xinmei, 2022; Lynne Bilston, Mills, Kent, Julie Brown, Whyte, 2022; Xuerong, Yanxiao, 2022). Safety seat studies have shown that rear-facing seats are safer than forward-facing seats, in part because they do not overload the child's muscles. That's why all i-Size safety seats can be installed rearward-facing up to 15 months of age. i-Size safety seats are available in three different sizes, each with an approximate equivalent in the R44 sizing system. We distinguish the following sizes (Tellier, Pormente, Meyer, Bourdet, Willinger, Renaudin, 2018; Cornelissen, Hermans, Tuijl, Versteeg, Beeck, Kemler (2021):

- 0-85 cm (approx. G0+ in the mass system) – rearward-facing carrier or child seat with harness,
- 0-105cm (approx. G0/1/2) – rearward-facing seat until the child is at least 76cm tall, then forward-facing,
- 100-135 cm (approx. G2/3) – forward-facing seat.

On 1 September 2023, the R44 car seat standard was withdrawn and replaced by the European standard R129. Current car seat regulations continue to allow the use of safety seats that comply with R44 or R129 standards. Please note that from 1 September 2024, the sale of safety seats that comply with the previous standard will be banned in the EU, while their use will be allowed for at least 8 years (CAR SEAT BUYERS GUIDE, 2023; Zuska, Szumska, & Frej, 2021; Frej, Grabski, 2019).

So, it should be noted that the R129 standard determines whether the car seat is suitable for a child based on both height and mass. This distinguishes this standard from the R44/04 standard, which only uses mass.

Regardless of the type of car seat parents or legal guardians choose, it must be securely fastened to the vehicle. There are several methods for installing a car seat, including using standard seat belts or using standard seat belts with tethers attached to the driver/passenger seat rail or floor. Another method of securing a car seat is the ISOFIX system, where the child seat is attached to the vehicle's seat frame. The rear seats of most new vehicles (manufactured since 2013) have multiple attachment points. These points connect to a separate ISOFIX base (often sold with the car seat), providing an exceptionally strong connection. The car seat is then attached to the ISOFIX base, eliminating the need to re-thread belts around or through the seat, or tighten harnesses in the seats or vehicle floor (Frej, Grabski, 2019; Zaloshnja, Miller, Hendrie, 2007; Dulf, Peek-Asa, Jurchiș, Bărăgan, 2020).

In recent years, many new design solutions and improvements have been made to safety seats. In terms of safety, there are two main solutions: the five-point seat belt system and the built-in airbags. The seat with a five-point seat belt system is equipped with a special seat belt mechanism that automatically adjusts the belt tension (Active Retract Harness 2023; Why Choose a Car Seat with Built-in Airbags, 2023). The mechanism that regulates the belt tension allows you to properly secure the child

while riding. When the child is fastened in the vehicle seat, the seat belts tighten automatically when the child leans back. This solution helps parents to position their child correctly in the seat (Britax Römer Baby Safe iSENSE i-Size with base, 2023). An important solution to improve the safety of the child during travel is a seat with built-in airbags. The seat has a collision detection system installed in the ISOFIX system, built-in airbags and a side protection system. The cushions are placed in the seat belts supporting the child's body. After receiving information from the sensors, the system activates the airbag and side protection inflation mechanism. This ensures that the child's head and neck are protected in the event of a collision (European Road Safety Observatory, 2023).

In recent years, several solutions have also been introduced to improve the comfort of the child in the car seat. An example of a system with the possibility is the adjustment of the angle of inclination of the child seat based on ISOFIX. Proper positioning of the seat to ensure a safe and comfortable position for the transported child during the journey. In addition, flat positioning technology has been developed in newborn safety seats. The backrest and headrest tilt adjustment mechanism increases the amount of free space and allows the child to be transported in a lying position. The length of the shoulder straps is adjusted automatically after adjusting the headrest to ensure the child's safety during the journey (Muszyński, Łuszczek, Szymaniuk, 2020). Another solution is to illuminate the inside of the seat and the base of the seat. LED lights are located in the headrest and at the bottom of the seat. Additional lighting on the underside of the seat makes it easy to assemble and disassemble. The lights turn on automatically when they sense movement (Popa, Ciongradi, Sârbu, Bică, Popa, Bulgaru-Iliescu, 2023).

To monitor a child placed in a rear-facing seat, the solution available so far is a rear-view mirror. The mirror is mounted on the rear seat, ensuring eye contact with the child while driving the vehicle without having to turn around. The convex surface provides a wide viewing angle. Illuminated mirrors also allow you to observe when driving at night. As mentioned earlier, it is mandatory to transport your child in a safety seat. EU and national law impose safety standards on manufacturers that safety seats must meet before they can be sold. In 2020 386 children (aged 0-14) were killed in road accidents in the EU (Reduction in child fatalities on European roads in 2023; Lansdown, 2012) tags. Among the victims, 30% are children under the age of 6 (Park, Yoo, 2023). Despite continuous research, there is a need to introduce further design solutions for safety seats. A car seat should be safe, ergonomic and comfortable for the child travelling in it. In addition, it should provide parents or caregivers with the opportunity to make eye contact with the child (Bakhurji, Alqahtani, Alwashmi).

The article focused on a rarely published topic in the literature, concerning the identification of factors influencing the purchasing preferences of child safety seats. The conducted activities included the preparation, execution, and analysis of

survey research. In the article, Chapter Two presented information regarding the course and implementation of the survey research. In Chapter Three, the results of purchasing preferences for child safety seats were presented, divided by the gender of the respondents. Finally, the conclusions drawn from the conducted research are provided at the end of the work.

## **Research**

On the market, there is a wide range of different models and manufacturers of child safety seats available. According to the information provided by manufacturers and sellers, each of them is “perfectly suited” for transporting children. It is important to note that safety seats will vary in appearance, shape, how they are installed, price, safety rating, or mass or appearance. For most parents, the problem of choosing a child seat is related to the lack of knowledge about its construction, durability and crash tests of safety seats. Lack of knowledge can lead to wrong purchasing decisions. For this purpose, a questionnaire on the choice of a car seat for a child has been prepared. A total of 2421 respondents participated in the study. The research was conducted at the Department of Automotive Vehicles and Transport of the Kielce University of Technology. The survey questions were formulated based on the experience of department staff and verified in a preliminary study involving 25 individuals (mostly industry specialists). Initially, the survey questionnaire contained 40 questions, but the number of questions was reduced to 32. Questions regarding the price of purchased child safety seats or the choice of manufacturer of the owned child seat were among those eliminated. The responses from the preliminary survey were not used in the analysis of the research results; they were only utilized to validate the questionnaire’s accuracy.

In the study, 482 respondents who did not have children and 964 respondents who purchased child safety seats from an online store participated. If a respondent indicated in the control question that they did not have children, the survey questionnaire automatically stopped collecting data and thanked them for participating in the study. However, if a respondent in the second control question indicated that they purchased a safety seat from an online store, the survey questionnaire allowed them to provide further responses. The responses of these individuals were not included in the analysis of the research results. Additionally, 25 individuals who had children over 6 years old participated in the study. Likewise, the responses of these individuals were not included in the analysis of the research results. Therefore, 950 valid surveys were conducted. The research results underwent statistical analysis considering the gender of the respondents. Statistical analysis was performed using IBM Statistics software, calculating significance coefficient and chi-square.

## **Research assumptions**

The study was conducted to find out about the preferences and behaviors of parents and legal guardians regarding the choice of a child seat. In accordance with the topic of the work, the questions were selected in such a way as to obtain as much information as possible regarding the state of knowledge of parents, their key preferences and awareness of the risks resulting from the poor welfare of safety seats. The aim of the research is to answer the following questions:

- What do parents consider when choosing a safety seat?
- Are there differences between men and women in the importance of the factors that determine the ploughing of a car seat?

In the study, the decision was made to compare the difference in purchasing preferences for child safety seats among respondents based on gender, aiming to examine which factors determine the purchase of a seat for women versus men. Understanding purchasing preferences based on gender will help develop guidelines for parents to consider when buying a child safety seat.

## **Research Methodology**

The survey was conducted between 01.10.2020 and 01.10.2022 with the use of Google's survey platform. The survey was promoted on websites and social networks dealing with the subject of safety seats and accessories for children. Participants were random people who took the time to complete a survey, thereby declaring their participation in the study. A diagram of the data collection flow process is shown in Figure 1.

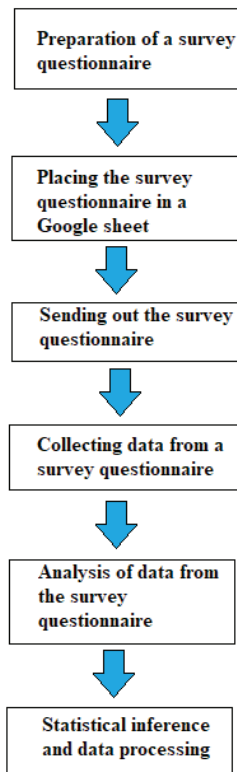


Fig. 1. Flow chart of the measurement data collection process

Source: Author's own elaboration

## Implementation of research

Only adults who voluntarily expressed their willingness to participate in the survey could take part in the survey. Only people with a child under 6 years of age could take part in the study. Another condition for taking part in the study was the information that the safety seat was purchased in a stationary store. People with children over 6 years of age were not able to answer all the questions in the questionnaire. Like people who bought a car seat online, they couldn't answer all the questions in the survey questionnaire. The pattern of respondent selection is shown in Figure 2.

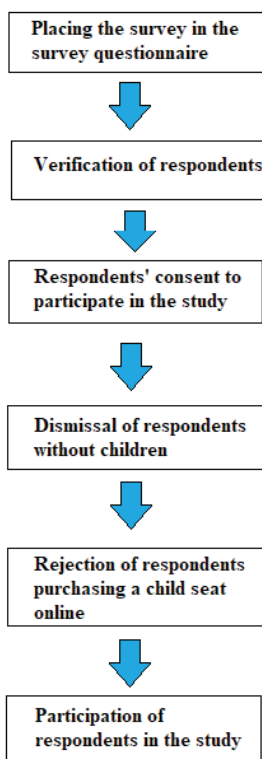


Fig. 2. Scheme of selection of respondents for the study

Source: Author's own elaboration

## Sample of respondents

Respondents were diverse in terms of gender, age and education. The study involved 521 women (55%) and 429 men (45%). The largest group of respondents are people aged 18 to 25 (487 people, constituting as much as 51% of all respondents). In terms of education, 23 people with lower secondary education, 185 people with vocational education, 234 people with general secondary education, 267 people with secondary vocational education and 241 people with higher education took part in the study. The demographic profile of the respondents is presented in Table 1.



Table 1. Demographic profile of respondents

| Sex                                     | Number, <i>n</i> | Percentage, % |
|---|------------------|---------------|
| Woman                                   | 521              | 55            |
| Men                                     | 429              | 45            |
| Age of respondents (years)              | Number, <i>n</i> | Percentage, % |
| 18-25                                   | 487              | 51            |
| 26-35                                   | 275              | 29            |
| 36-45                                   | 112              | 12            |
| 46-60                                   | 55               | 6             |
| 60 +                                    | 21               | 2             |
| Education                               | Number, <i>n</i> | Percentage, % |
| Upper secondary school (ISCED 1, 2)     | 23               | 2             |
| Upper secondary education (ISCED 3)     | 185              | 19            |
| General secondary education (ISCED 4)   | 234              | 25            |
| Vocational secondary schools (ISCED 4)  | 267              | 28            |
| (ISCED 5, 6, 7)                         | 241              | 25            |
| House                                   | Number, <i>n</i> | Percentage, % |
| city up to 50 thousand inhabitants      | 241              | 25            |
| city of 50,000 to 150,000 inhabitants   | 139              | 15            |
| city of 150,000 to 500,000 inhabitants  | 121              | 13            |
| city with more than 500,000 inhabitants | 95               | 10            |
| Village                                 | 354              | 37            |
| Number of children                      | Number, <i>n</i> | Percentage, % |
| 1                                       | 357              | 38            |
| 2                                       | 366              | 39            |
| 3                                       | 156              | 16            |
| More than 3                             | 71               | 7             |

Source: Author's own elaboration

The survey involved 357 respondents with one child. In addition, 366 respondents had two children, 156 respondents had three children, and 71 respondents had more than three children. Of all respondents, 354 live in rural areas, 241 people live in a city with up to 50,000 inhabitants, 139 people live in a city with 50,000 to 150,000 inhabitants, 121 people live in a city with 150,000 to 500,000 inhabitants, and 95 people live in a city with more than 500,000 inhabitants.

Parents or legal guardians were asked how often they travel with their child in a car seat. The respondents are shown in Figure 3. It is worth noting that 253 respondents declared that they often travel with their child in a child seat. As many as 71 respondents did not give a clear answer.

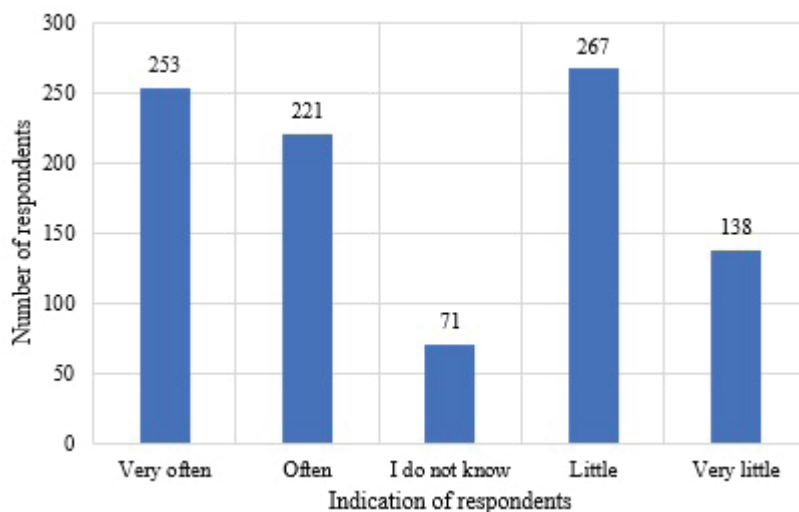


Fig. 3. How often do you travel in a passenger car with a child seat?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 2. The statistical significance coefficient is  $p = 0.00001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the frequency of travel in a passenger car with a child placed in a child seat. The difference is due to the length of the route. Men travel with their children in safety seats much more often on long journeys than women. The very short distances and the longest distances are carried out by men. It should be noted that 19% of the surveyed women and 35.90% of the surveyed men travel very often with a child. In addition, 34.36% of the women surveyed and 20.51% of the men surveyed do not travel much with their children.

Table 2. How often do you travel in a passenger car with a child seat – a breakdown by the gender of the respondents

| Answer        | Woman             |        | Man        |        |
|---------------|-------------------|--------|------------|--------|
|               | <i>n</i>          | %      | <i>n</i>   | %      |
| Very common   | 99                | 19.00% | 154        | 35.90% |
| Often         | 103               | 19.77% | 118        | 27.51% |
| I do not know | 65                | 12.48% | 6          | 1.40%  |
| Small         | 179               | 34.36% | 88         | 20.51% |
| Very little   | 75                | 14.40% | 63         | 14.69% |
| Chi-square    | $\chi^2 = 85,958$ |        | $D.F. = 4$ |        |
|               | $p = 0.00001$     |        |            |        |

Source: Author’s own elaboration

In the next question, respondents were asked to indicate the travel time of a child in a child seat during the week (Fig. 4). It should be noted that the largest number of respondents (324 people) indicated between 1 and 3 hours of travel of a child in a child seat per week. As many as 133 respondents declare an hour of travel of a child in a car seat per week, and as many as 172 respondents declare more than 6 hours. The travel time of a child in a car seat from 3 to 6 hours per week is declared by 321 respondents.

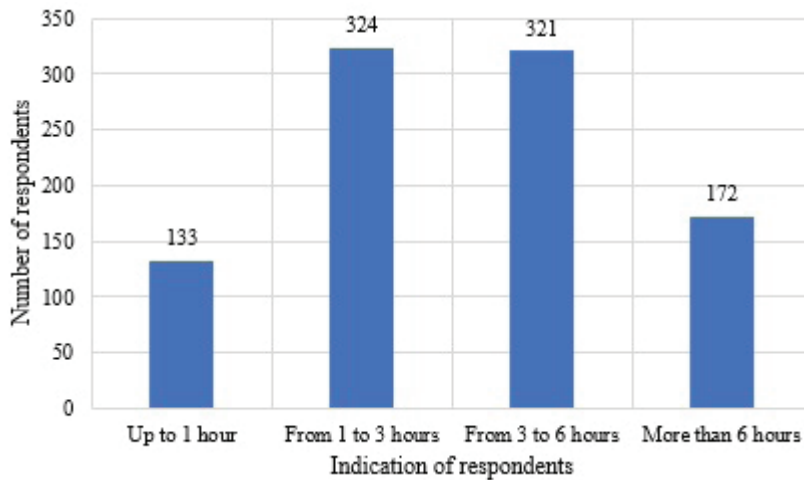


Fig. 4. Travel time of a child in a child seat during the week

Source: Author’s own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 3. The statistical significance coefficient is  $p = 0.00001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the time of travel with a child placed in a child seat during the week. It should be noted that 8.95% of the surveyed women and 11.19% of the surveyed men declare the travel time of a passenger car with a child placed in a car seat up to 1 hour per week. Travel time from 1 hour to 3 hours is declared by 25.37% of the surveyed women and 19.35% of the surveyed men. In addition, travel time of 3 to 6 hours is declared by 14.74% of the surveyed women and 42.19% of the surveyed men. Only 5.79% of the surveyed women and 27.27% of the surveyed men declare more than 6 hours of travel.

Table 3. Travel time of a child in a child seat during the week – division by gender of the respondents

| Answer            | Woman              |        | Man        |               |
|-------------------|--------------------|--------|------------|---------------|
|                   | <i>n</i>           | %      | <i>n</i>   | %             |
| Up to 1 hour      | 85                 | 8.95%  | 48         | 11.19%        |
| 1 to 3 hours      | 241                | 25.37% | 83         | 19.35%        |
| 3 to 6 hours      | 140                | 14.74% | 181        | 42.19%        |
| More than 6 hours | 55                 | 5.79%  | 117        | 27.27%        |
| Chi-square        | $\chi^2 = 107,022$ |        | $D.F. = 3$ | $p = 0.00001$ |

Source: Author's own elaboration

Respondents were then asked how the safety seat was attached to the vehicle (Fig. 5). The largest group of respondents, numbering 455 people, are people who attach the purchased child seat using a standard ISOFIX base. The fewest respondents (241 people) secure the car seat with standard seat belts. In addition, as many as 254 respondents have a car seat with a rotating ISOFIX base.

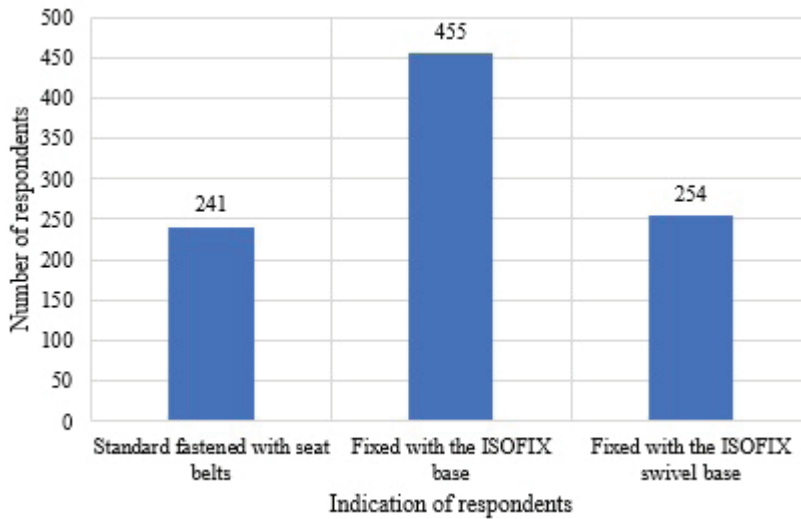


Fig. 5. How to attach a child seat to a passenger car

Source: Author’s own elaboration

Subsequently, the respondents’ indications were divided by gender. The results are shown in Table 4. The statistical significance coefficient is  $p = 0.0006$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the way in which a child seat is installed in a passenger vehicle. It should be noted that 27.26% of the women surveyed and 23.08% of the men surveyed use standard seat belts. With the help of a swivel base, the seat is installed by 31.09% of the surveyed women and 21.45% of the surveyed men. This may be due to the comfort of getting the child in and out of the seat. For women, an easier method is to rotate the seat in the base. As many as 41.65% of the surveyed women and 55.48% of the surveyed men install the seat using the standard ISOFIX base. It should be noted that more than 55% of the men surveyed have a child seat installed using a standard ISOFIX base.

Table 4. How to attach a child seat to a passenger car – division by gender

| Answer                               | Woman             |        | Man             |              |
|--------------------------------------|-------------------|--------|-----------------|--------------|
|                                      | <i>n</i>          | %      | <i>n</i>        | %            |
| Fastened with seat belts as standard | 142               | 27.26% | 99              | 23.08%       |
| Anchoring with an ISOFIX base        | 217               | 41.65% | 238             | 55.48%       |
| Attachment with ISOFIX swivel base   | 162               | 31.09% | 92              | 21.45%       |
| Chi-square                           | $\chi^2 = 19,203$ |        | <i>D.F.</i> = 2 | $p = 0.0006$ |

Source: Author’s own elaboration

Respondents were then asked to indicate where they were attaching the child seat (Figure 6). It should be noted that the largest group are people installing a child seat in a passenger vehicle on the back seat of the vehicle behind the driver's seat (427 people). In addition, it should be noted that as many as 241 respondents declare the installation of a child seat in the front seat. Installation in this place is not recommended by manufacturers of safety seats, and yet such a large group of respondents declared this method of installation. 213 respondents declared that they would install the seat on the rear bench behind the passenger seat, while only 69 respondents would install the seat in the rear seat in the middle seat. It should be noted that the safest place to install a child seat, according to crash tests carried out by safety seat manufacturers, is in the back seat in the middle position. However, in most passenger vehicles, it is not possible to place a child seat in this place, mainly due to the lack of installation of the ISOFIX system, as well as the 2/3 folding backrest of the rear seat. The second potentially safe place to install a child seat, according to a study by child seat manufacturers, is the back seat behind the driver's seat.

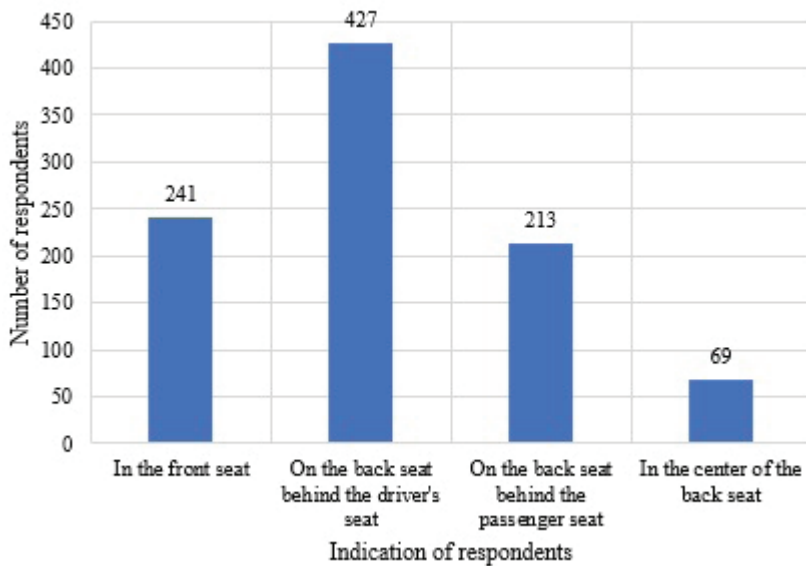


Fig. 6. Installation location of the child seat in a passenger vehicle

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are presented in Table 5. The statistical significance coefficient is  $p = 0.00001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the place where the child seat is attached in a passenger vehicle. It should be noted that in the safest place (the middle seat of the back seat) only 1.34% of the surveyed

women and 14.45% of the surveyed men install a car seat in a passenger vehicle. As many as 26.68% of the surveyed women and 23.78% of the surveyed men install a child seat in the front seat. A child seat on the back seat behind the driver’s seat is installed by as many as 49.33% of the surveyed women and 39.63% of the surveyed men. On the back seat behind the passenger seat, 22.65% of the surveyed women and 22.14% of the surveyed men install a child seat.

Table 5. Place of installation of a child seat in a passenger vehicle – division by gender of respondents

| Answer                                     | Woman             |       | Man        |               |
|--|-------------------|-------|------------|---------------|
|  | <i>n</i>          | %     | <i>n</i>   | %             |
| In the front seat                          | 139               | 26.68 | 102        | 23.78         |
| In the back seat behind the driver’s seat  | 257               | 49.33 | 170        | 39.63         |
| In the back seat behind the passenger seat | 118               | 22.65 | 95         | 22.14         |
| In the middle of the rear seat             | 7                 | 1.34  | 62         | 14.45         |
| Chi-square                                 | $\chi^2 = 91,397$ |       | $D.F. = 3$ | $p = 0.00001$ |

Source: Author’s own elaboration

### Purchasing preferences for safety seats

The collected survey data was statistically analyzed in Excel 2016. In one of the survey questions, respondents indicated what they paid attention to when buying a child seat (Fig. 7). Respondents could choose more than one answer. The most common indication of the respondents was the price. As many as 551 respondents paid attention to the price when choosing a child seat. For 458 respondents, the mass of the seat was an important parameter when choosing a car seat, and for 437 respondents, the method of installation. The crash test certificate was an important parameter for only 267 respondents. The data collected shows that public opinion is a more important parameter than a crash test certificate deciding on the purchase of a child seat. As many as 367 respondents suggested public opinion. On the other hand, 267 respondents paid attention to the comfort of the child in the seat. Thus, more respondents paid attention to the brand of the child seat (321 people) than to the comfort of the child. 125 respondents paid attention to the appearance of the safety seat during the purchase, and 128 respondents paid attention to the integrity of the car seat with the stroller. The fewest people (87 respondents) paid

attention to the materials from which the child seat is made. Only 99 respondents paid attention to the stability of the car seat installation in the vehicle.

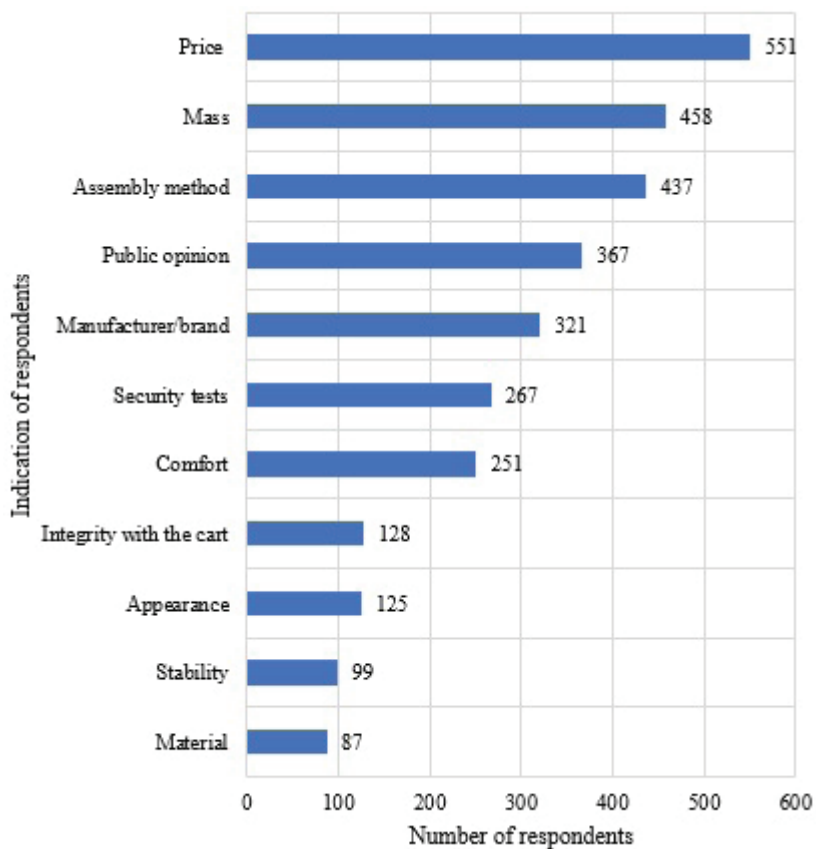


Fig. 7. What did you consider when buying a child seat?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 6. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the purchasing preferences of a child seat. It should be noted that 41.07% of the surveyed women and 78.55% of the surveyed men pay attention to the price of the seat. The comfort of travelling in a child seat is noticed by 36.08% of the surveyed women and 14.69% of the surveyed men. Crash test certificates are noted by 21.88% of the surveyed women and 35.66% of the surveyed men. The integrity of a child seat with a baby stroller is an important parameter when purchasing a child seat



for 16.59% of the women surveyed and 9.32% of the men surveyed. When buying a child seat, 48.94% of the women surveyed and 15.38% of the men surveyed pay attention to the brand. The mass of the seat is an important parameter determining the purchase of a car seat for 57.39% of the surveyed women and 37.06% of the surveyed men. The method of installing a child seat is an important purchasing parameter for 52.78% of the surveyed women and 37.76% of the surveyed men. The stability of the seat installation is noted by 7.87% of the surveyed women and 13.52% of the surveyed men when buying. The material from which the child seat is made is an important parameter influencing the choice of car seat for 4.03% of the surveyed women and 15.38% of the surveyed men. The appearance of a child seat is an important parameter when choosing a car seat for 19.58% of the women surveyed and 5.36% of the men surveyed.

Table 6. What did you take into account when buying a child seat – a breakdown by the gender of the respondents

| Answer              | Woman             |        | Man        |        |
|---------------------|-------------------|--------|------------|--------|
|                     | <i>n</i>          | %      | <i>n</i>   | %      |
| Price               | 214               | 41.07% | 337        | 78.55% |
| Comfort             | 188               | 36.08% | 63         | 14.69% |
| Security Testing    | 114               | 21.88% | 153        | 35.66% |
| Public opinion      | 278               | 53.36% | 89         | 20.75% |
| Carriage Integrity  | 88                | 16.89% | 40         | 9.32%  |
| Manufacturer/Brand  | 255               | 48.94% | 66         | 15.38% |
| Mass                | 299               | 57.39% | 159        | 37.06% |
| Installation method | 275               | 52.78% | 162        | 37.76% |
| Stability           | 41                | 7.87%  | 58         | 13.52% |
| Material            | 21                | 4.03%  | 66         | 15.38% |
| Appearance          | 102               | 19.58% | 23         | 5.36%  |
| Chi-square          | $\chi^2 = 319.01$ |        | $D.F. = 9$ |        |
|                     | $p = 0.0001$      |        |            |        |

Source: Author's own elaboration

In the next question, respondents were asked about the possibility of testing the car seat before the purchase by the child (Fig. 8). According to respondents, as many as 269 people declare that their child could test the car seat before buying. On the contrary, 125 respondents declare such a possibility. 127 respondents declare that they do not have such a possibility, and 397 respondents declare that they do not have such a possibility.

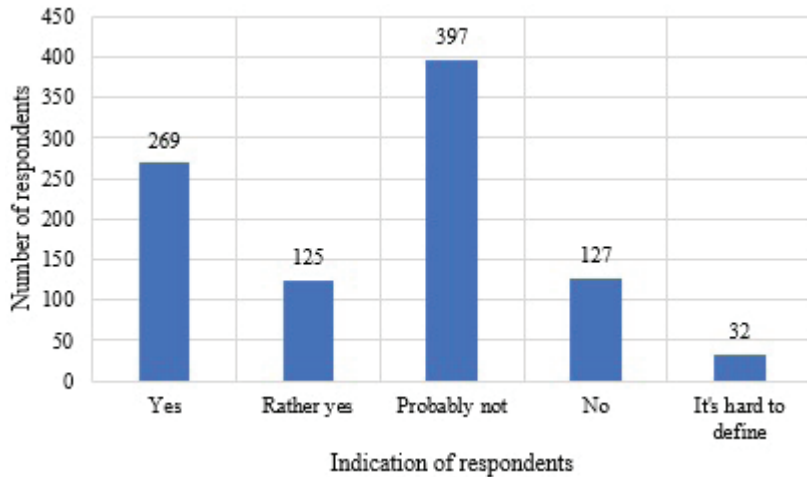


Fig. 8. Possibility to test the seat before the purchase by the child  
Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 7. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the subjects affects the child's ability to test the seat before making a purchase. It should be noted that 39.35% of the surveyed women and only 14.92% of the surveyed men declared such a possibility. On the contrary, 10.56% of the surveyed women and 16.32% of the surveyed men had such a possibility. Probably as many as 30.90% of the surveyed women and 55.01% of the surveyed men did not have such a possibility. Certainly, 17.66% of the surveyed women and 8.16% of the surveyed men did not have such an opportunity.

Table 7. The possibility of testing the car seat before the purchase by the child – division by gender of the respondents

| Answer              | Woman              |        | Man        |             |
|---------------------|--------------------|--------|------------|-------------|
|                     | <i>n</i>           | %      | <i>n</i>   | %           |
| Yes                 | 205                | 39.35% | 64         | 14.92%      |
| Hardly, yes         | 55                 | 10.56% | 70         | 16.32%      |
| Probably not        | 161                | 30.90% | 236        | 55.01%      |
| No                  | 92                 | 17.66% | 35         | 8.16%       |
| It's hard to define | 8                  | 1.54%  | 24         | 5.59%       |
| Chi-square          | $\chi^2 = 104,195$ |        | $D.F. = 3$ | $p = 0.001$ |

Source: Author's own elaboration

A follow-up question asked respondents whether the seller offered to try on a child seat in a passenger vehicle (Figure 9). Unfortunately, it should be noted that trying on a car seat in your own vehicle is still not a popular activity. In addition, most brick-and-mortar stores do not allow you to try on a car seat in your own vehicle unless the customer is determined to buy. According to respondents, only 142 people had the opportunity to try it on their vehicle when buying a child seat. Rather, 236 respondents had such a possibility. A large group of 402 respondents declared that the seller did not offer to try on a car seat in their vehicle. A definite lack of such a possibility was declared by 137 respondents.

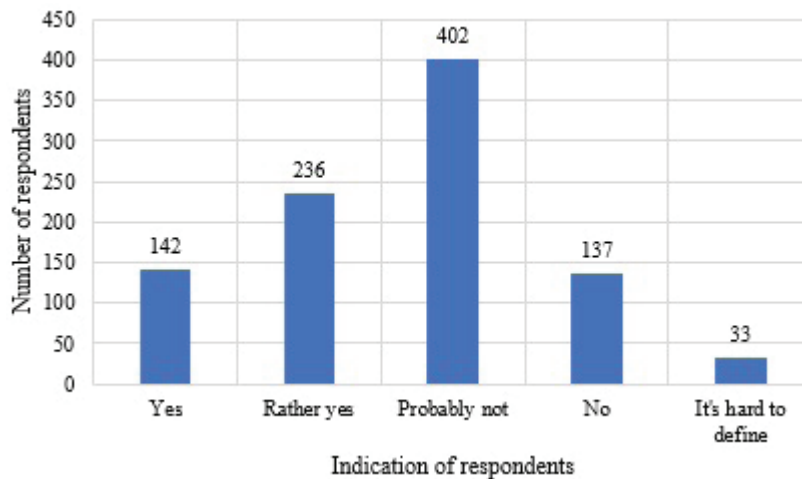


Fig. 9. Possibility to try on a child seat in a passenger vehicle before making a purchase.

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 8. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the possibility of trying on a child seat in a passenger vehicle before making a purchase. It should be noted that 17.66% of the surveyed women and 11.66% of the surveyed men had this option when they last purchased a child seat. A definite lack of such a possibility was declared by 16.31% of the surveyed women and 12.12% of the surveyed men. Probably 31.67% of the surveyed women and 55.24% of the surveyed men declared that they did not have such a possibility.

Table 8. The possibility of trying on a child seat in a passenger vehicle before making a purchase – a breakdown by gender of the respondents

| Answer              | Woman             |        | Man        |              |
|---------------------|-------------------|--------|------------|--------------|
|                     | <i>n</i>          | %      | <i>n</i>   | %            |
| Yes                 | 92                | 17.66% | 50         | 11.66%       |
| Hardly, yes         | 167               | 32.05% | 69         | 16.08%       |
| Probably not        | 165               | 31.67% | 237        | 55.24%       |
| No                  | 85                | 16.31% | 52         | 12.12%       |
| It's hard to define | 12                | 2.30%  | 21         | 4.90%        |
| Chi-square          | $\chi^2 = 68,146$ |        | $D.F. = 4$ | $p = 0.0001$ |

Source: Author's own elaboration

In the next question, respondents were asked to indicate whether the car seat they had purchased had a system that informs them about the correct installation (Fig. 10). It is worth noting that as many as 342 respondents declared that their car seat is equipped with a correct installation system. In addition, 221 respondents declared that their car seat rather has such a system. Only 125 respondents declared that they did not have a system to indicate the correct installation of a child seat in a passenger vehicle, and 241 people declared that their child seat did not have such a system.

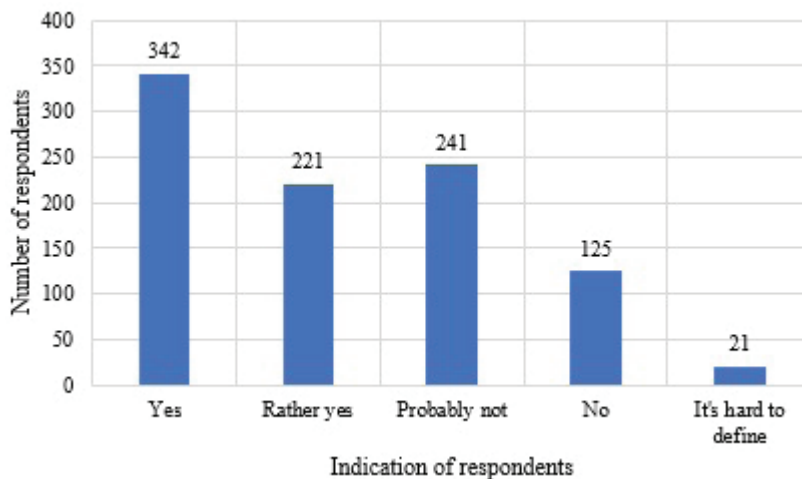


Fig. 10. Does the car seat you have purchased has a system that informs you about the correct installation in a passenger vehicle?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 9. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the purchase of a child seat with an additional system informing about the correct installation in a child seat in a passenger vehicle. It should be noted that 48.18% of the women surveyed and only 21.21% of the men surveyed had purchased a car seat with such an information system. In addition, 19.39% of the surveyed women and 27.97% of the surveyed men rather bought a car seat with such a system informing about the correct installation. The lack of such a system is rather present in the purchased safety seats in 20.15% of the surveyed women and 31.70% of the surveyed men. A definite lack of such a system occurs in safety seats purchased by 10.56% of the surveyed women and 16.32% of the surveyed men.

Table 8. Does the purchased car seat have a system informing about the correct installation in a passenger vehicle – division by gender of the respondents

| Answer              | Woman             |        | Man        |        |
|---------------------|-------------------|--------|------------|--------|
|                     | <i>n</i>          | %      | <i>n</i>   | %      |
| Yes                 | 251               | 48.18% | 91         | 21.21% |
| Hardly, yes         | 101               | 19.39% | 120        | 27.97% |
| Probably not        | 105               | 20.15% | 136        | 31.70% |
| No                  | 55                | 10.56% | 70         | 16.32% |
| It's hard to define | 9                 | 1.73%  | 12         | 2.80%  |
| Chi-square          | $\chi^2 = 74,493$ |        | $D.F. = 4$ |        |
|                     | $p = 0.0001$      |        |            |        |

Source: Author's own elaboration

Respondents were asked whether they had paid attention to child seat safety test certificates and their ratings when purchasing a child seat (Figure 11). It should be noted that as many as 267 respondents do not pay attention to the safety test certificates of the child seat and the evaluation of these tests when buying a car seat. In addition, the 247 respondents probably did not pay attention to the safety test certificates of safety seats and the evaluation of these tests. Only 157 respondents paid attention to the safety test certificates of safety seats before purchasing, and 174 respondents rather paid attention to their safety test certificates and their rating.

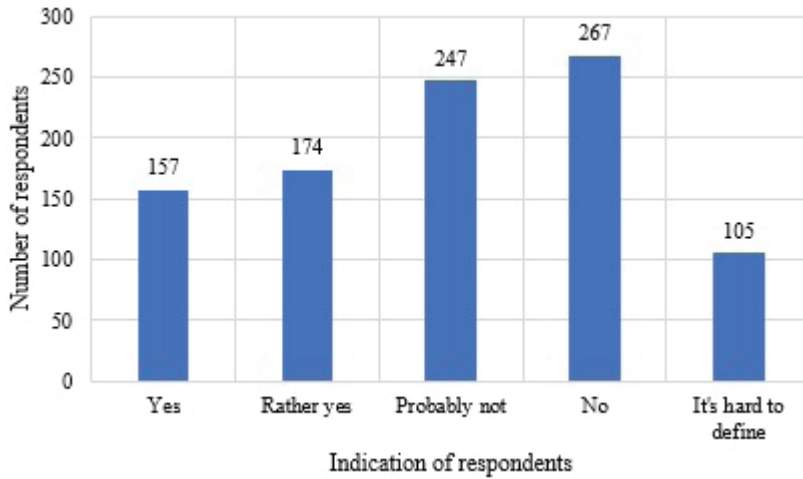


Fig. 11. When buying a child seat, did you pay attention to the child seat safety test certificates and their ratings?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 10. The statistical significance coefficient is  $p = 0.0012$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the attention paid to child seat safety tests when deciding whether to purchase a child seat. It should be noted that only 14.40% of the surveyed women and 19.11% of the surveyed men paid attention to the safety test certificates of safety seats before purchasing. On the other hand, safety test certificates for safety seats before purchase were not noticed by as many as 27.26% of the surveyed women and 29.14% of the surveyed men.

Table 10. When buying a child seat, have you paid attention to the child seat safety test certificates and their ratings - a breakdown by the gender of the respondents

| Answer              | Woman             |        | Man        |        |
|---------------------|-------------------|--------|------------|--------|
|                     | n                 | %      | n          | %      |
| Yes                 | 75                | 14.40% | 82         | 19.11% |
| Hardly, yes         | 93                | 17.85% | 81         | 18.88% |
| Probably not        | 134               | 25.72% | 113        | 26.34% |
| No                  | 142               | 27.26% | 125        | 29.14% |
| It's hard to define | 77                | 14.78% | 28         | 6.53%  |
| Chi-square          | $\chi^2 = 18,135$ |        | $D.F. = 4$ |        |
|                     | $p = 0.0012$      |        |            |        |

Source: Author's own elaboration

Respondents were asked if they had paid attention to its mass before purchasing a child seat (Fig. 12). It should be noted that only 75 respondents paid attention to the mass of the child seat, and 115 respondents rather paid attention to the mass of the child seat. However, as many as 341 respondents did not pay attention to the mass of the seat when buying, and 389 respondents rather did not pay attention to the mass of the seat when buying.

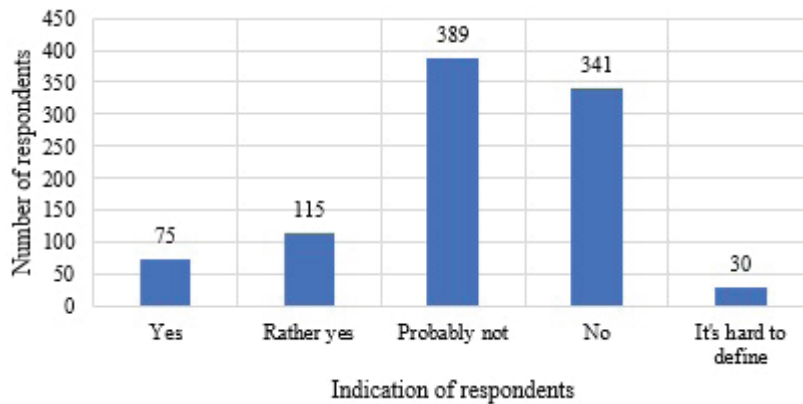


Fig. 12. Did you pay attention to its mass before buying a child seat?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 11. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the attention paid to the mass of the seat when buying it. It should be noted that the mass of the seat was noticed by 10.56% of the surveyed women and 4.66% of the surveyed men. The mass of the seat was noticed by 15.74% of the surveyed women and 7.69% of the surveyed men. It should be noted that almost 50% more women than men pay attention to the mass of a child seat.

Table 11. Did you pay attention to its mass before buying a child seat – division by gender of the respondents

| Answer              | Woman             |        | Man             |              |
|---------------------|-------------------|--------|-----------------|--------------|
|                     | <i>n</i>          | %      | <i>n</i>        | %            |
| Yes                 | 55                | 10.56% | 20              | 4.66%        |
| Hardly, yes         | 82                | 15.74% | 33              | 7.69%        |
| Probably not        | 162               | 31.09% | 227             | 52.91%       |
| No                  | 208               | 39.92% | 133             | 31.00%       |
| It's hard to define | 14                | 2.69%  | 16              | 3.73%        |
| Chi-square          | $\chi^2 = 52,658$ |        | <i>D.F.</i> = 4 | $p = 0.0001$ |

Source: Author's own elaboration

Respondents were asked whether they pay attention to the opinions of other users of the selected seat on the Internet when buying a child seat (Fig. 13). It is worth noting that 461 respondents checked the opinion of other users of the selected seat before making a purchase. In addition, 363 respondents declare that they would rather check online reviews of the seat before making a purchase decision. Only 48 respondents declare that they did not check the opinions of other users on the Internet when buying a child seat, and 55 respondents were unlikely to check the opinions of other users when buying a child seat.

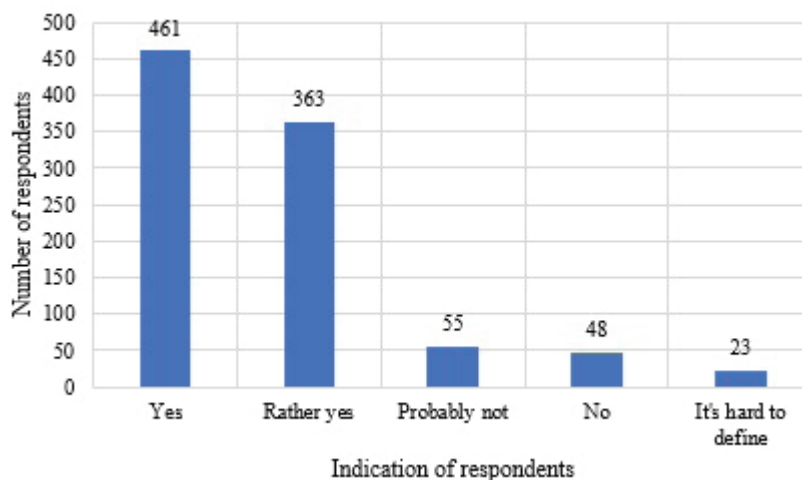


Fig. 13. When buying a child seat, have you checked the opinions of other users of the car seat you have chosen on the Internet?

Source: Author's own elaboration



Subsequently, the respondents' indications were divided by gender. The results are shown in Table 12. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents influences the verification of other users' opinions on the Internet about the selected child seat before making a purchase. It should be noted that as many as 71.40% of the surveyed women and only 20.75% of the surveyed men checked the opinions of other users on the Internet before buying a car seat. When buying a child seat, 25.34% of the surveyed women and 53.85% of the surveyed men checked the opinions of other Internet users.

Table 11. When buying a child seat, have you checked the opinions of other users of the selected car seat on the Internet – division by gender of the respondents?

| Answer              | Woman              |        | Man             |              |
|---------------------|--------------------|--------|-----------------|--------------|
|                     | <i>n</i>           | %      | <i>n</i>        | %            |
| Yes                 | 372                | 71.40% | 89              | 20.75%       |
| Hardly, yes         | 132                | 25.34% | 231             | 53.85%       |
| Probably not        | 12                 | 2.30%  | 43              | 10.02%       |
| No                  | 3                  | 0.58%  | 45              | 10.49%       |
| It's hard to define | 2                  | 0.38%  | 21              | 4.90%        |
| Chi-square          | $\chi^2 = 264,216$ |        | <i>D.F.</i> = 4 | $p = 0.0001$ |

Source: Author's own elaboration

Respondents were asked whether they were guided by the comfort of the child placed in the seat on a specially prepared stand in a stationary store when choosing a car seat (Fig. 14). It should be noted that the comfort of the child placed in the seat was indicated by 241 respondents, and 133 respondents were rather guided by the comfort of the child placed in the seat when choosing a seat. It should be noted that placing a child in a child seat on a specially prepared stand in a stationary store, consisting of a car seat to which the selected child seat is attached, is not a reliable measurement of the child's comfort. Because the seat profile is contoured to increase the stability of the child seat, and the short time it takes to place the child in the child seat can lead to a wrong decision about the comfort of the child. The only right way to test your child's comfort in a child seat is to travel longer in a child seat installed in the vehicle. Thus, when buying a child seat, 246 respondents did not pay attention to the comfort of the child placed in the seat, and 246 respondents did not pay attention to the comfort of the child placed in the seat.

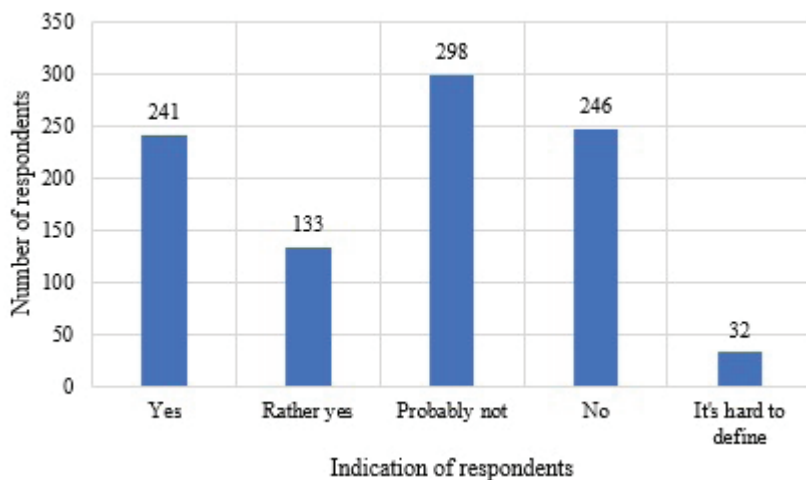


Fig. 14. When buying a child seat, did you pay attention to the comfort of the child placed in the seat?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 13. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the attention paid to the comfort of the child placed in a seat mounted on a special stand in a stationary store when buying a child seat. It should be noted that 25.34% of the surveyed women and 25.41% of the surveyed men paid attention to the comfort of the child placed in the child seat when making the decision to purchase a child seat. 26.68% of the surveyed women and 37.06% of the surveyed men definitely did not pay attention to the comfort of the child placed in the seat for a while during the decision to buy a car seat.

Table 12. When buying a child seat, did you pay attention to the comfort of the child placed in the seat – division by gender of the respondents

| Answer              | Woman             |        | Man             |              |
|---------------------|-------------------|--------|-----------------|--------------|
|                     | <i>n</i>          | %      | <i>n</i>        | %            |
| Yes                 | 132               | 25.34% | 109             | 25.41%       |
| Hardly, yes         | 79                | 15.16% | 54              | 12.59%       |
| Probably not        | 139               | 26.68% | 159             | 37.06%       |
| No                  | 165               | 31.67% | 81              | 18.88%       |
| It's hard to define | 6                 | 1.15%  | 26              | 6.06%        |
| Chi-square          | $\chi^2 = 40,894$ |        | <i>D.F.</i> = 4 | $p = 0.0001$ |

Source: Author's own elaboration

The penultimate question from respondents was whether their child in a car seat during the journey cries or is cranky (Fig. 15). It is worth noting that 105 respondents declared that their child always cries or is cranky when traveling in a child seat. It happens that a child cries in a child seat while traveling with 255 respondents. It happens that a child cries in a child seat while traveling with 136 respondents. From time to time, it happens that a child cries in a child seat while traveling with 321 respondents. A baby never cries in a child seat in 133 respondents.

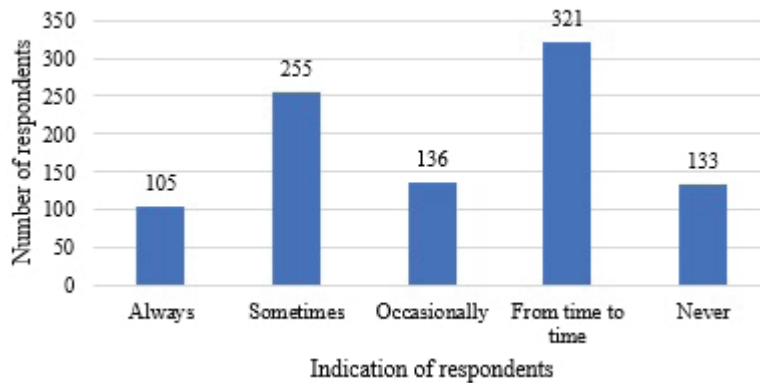


Fig. 15. Does your baby cry or whine in the child seat while traveling?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 14. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects the frequency of the baby's crying during the journey. It should be noted that during the journey, the child placed in the car seat always cries in 13.63% of the women surveyed and 7.93% of the men surveyed. It happens that 21.50% of the women surveyed and 33.33% of the men surveyed cry while traveling in a child seat. It happened that 12.48% of the surveyed women and 16.55% of the surveyed men were crying. 40.31% of women and 25.87% of men cry from time to time. A baby never cries in a child seat while traveling – 12.09% of women surveyed and 16.32% of men surveyed.

Table 13. Does the child cry or whine in the car seat during the journey – a breakdown by the gender of the respondents

| Answer            | Woman             |        | Man        |        |
|-------------------|-------------------|--------|------------|--------|
|                   | <i>n</i>          | %      | <i>n</i>   | %      |
| Always            | 71                | 13.63% | 34         | 7.93%  |
| Sometimes         | 112               | 21.50% | 143        | 33.33% |
| From time to time | 65                | 12.48% | 71         | 16.55% |
| From time to time | 210               | 40.31% | 111        | 25.87% |
| Never             | 63                | 12.09% | 70         | 16.32% |
| Chi-square        | $\chi^2 = 37,494$ |        | $D.F. = 4$ |        |
|                   | $p = 0.0001$      |        |            |        |

Source: Author's own elaboration

In the last question, respondents were asked if they would buy a child seat again (Fig. 16). It is worth noting that as many as 357 respondents would definitely not buy a child seat again. 235 respondents are unlikely to buy a child seat again. Only 145 respondents would buy the same car seat again and 115 would prefer to buy the same child seat.

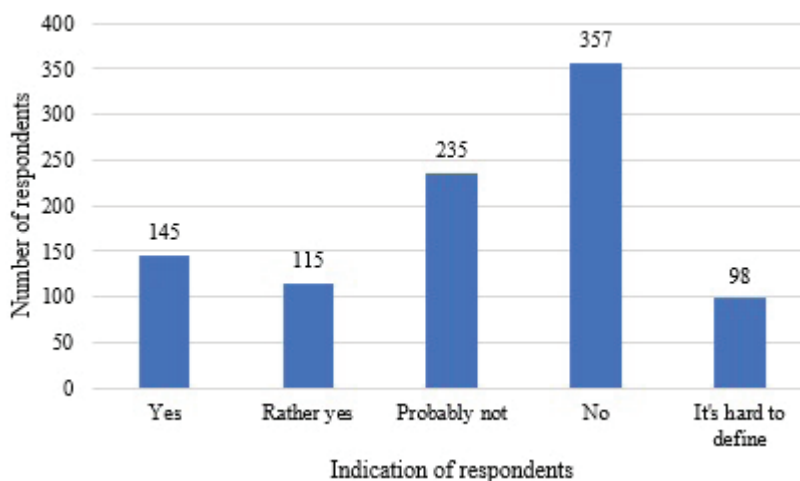


Fig. 16. Would you buy a child seat again?

Source: Author's own elaboration

Subsequently, the respondents' indications were divided by gender. The results are shown in Table 15. The statistical significance coefficient is  $p = 0.0001$  and is lower than the assumed significance level (0.05). Thus, the gender of the respondents affects their satisfaction with the child seat. It should be noted that only 12.48% of

the women surveyed and 18.65% of the men surveyed would decide to buy a child seat again. On the contrary, 13.05% of the women surveyed and 10.96% of the men surveyed would buy the same child seat again. 31.86% of the surveyed women and 16.08% of the surveyed men would not make the same decision to buy a car seat. Definitely the same decision to buy a car seat would not be made by 41.84% of the surveyed women and 32.40% of the surveyed men.

Table 15. Would you buy a car seat again – a breakdown by the gender of the respondents

| Answer              | Woman              |        | Man        |              |
|---------------------|--------------------|--------|------------|--------------|
|                     | <i>n</i>           | %      | <i>n</i>   | %            |
| Yes                 | 65                 | 12.48% | 80         | 18.65%       |
| Hardly, yes         | 68                 | 13.05% | 47         | 10.96%       |
| Probably not        | 166                | 31.86% | 69         | 16.08%       |
| No                  | 218                | 41.84% | 139        | 32.40%       |
| It's hard to define | 4                  | 0.77%  | 94         | 21.91%       |
| Chi-square          | $\chi^2 = 137,944$ |        | $D.F. = 4$ | $p = 0.0001$ |

Source: Author's own elaboration

## Discussion

The knowledge obtained from the surveys allowed us to obtain answers to the research questions. Out of 950 respondents, as many as 551 declared that the most important parameter determining the choice of a car seat is the price. It should also be noted that only 114 women and 153 men paid attention to their ratings in the crash tests of safety seats. As a result, more men than women paid attention to the ratings of safety seats in crash tests.

The topic of choosing a child seat is related to two aspects. The first concerns the age, mass and dimensions of the child. The second concerns the type of passenger car, in particular the shape of the rear seat. Safety seats available in the market are widely used child restraint devices in a child seat. In the paper (Park, Yoo, 2009), the authors developed a model of a light-mass child seat based on crash tests and simulations in the LS-DYNA software. The authors used an optimization sequence for each part of the seat to select the appropriate thickness of the materials. It should be noted that more than 400 respondents to the survey declared that they take into account the mass of the seat when choosing a child seat. It should also be noted that the mass of a child seat (excluding a child) varies from manufacturer to manufacturer. The lightest seats weigh 2.8 kg. In addition, the seats available on

the market can weigh up to more than 5 kg. So, adding the mass of the child to this result, you can see that the way from home to the parking lot with a car seat and a child can be a challenge for parents. This can be especially difficult for women, which is why studies show that women are more likely than men to pay attention to the mass of a child seat.

Numerous articles on the subject have presented the effectiveness of safety seats. Crash tests and child seat test procedures are designed to maintain a safety standard so that every seat on the market is safe for the child. Unfortunately, this knowledge is still not passed on to young parents. In the article (Bakhurji, Alqah-tani, Alwashmi, 2023), the authors focused on the research on the state of parents' knowledge in the use of safety seats. The authors noted that a large proportion of children travel without a child seat. This situation was caused by the lack of knowledge and difficult behavior of the children. In the paper (Tan RMR, Dong, Shen, Feng, Piragasam, Tyebally, Chong, 2019), the authors examined the impact of a social media advertising campaign on parents' knowledge of safety seats. The educational campaign was carried out by 303 volunteers. The authors emphasise that the educational campaign via social media has resulted in a significant increase in parents' knowledge and awareness of the importance of using safety seats correctly. It should be noted that our own research has shown that the knowledge of parents or legal guardians about safety seats is limited. In addition, as many as 357 respondents declared that they would not buy the same car seat twice. Gender also plays a big role when choosing a child seat, women were more likely than men to choose a child seat based on online reviews, they were more likely to pay attention to the appearance of the child seat than men. On the other hand, men are more likely than women to pay attention to the technical aspects of a child seat, such as safety certifications or the materials used.

In scientific articles (Zaloshnja, Miller, Hendrie, 2007; Dulf, Peek-Asa, Jurchiș, Bărăgan, 2020), the authors defined the vibration comfort of a child seat. According to the authors, a car seat installed with an ISOFIX base is exposed to greater vibrations from the road surface to the child seat than in the case of a seat installed with standard seat belts. Our own research has shown that the vibration comfort of a child seat is rarely taken into account by parents or legal guardians when deciding whether or not to purchase a child seat. It should also be noted that women are more likely than men to pay attention to the comfort of a child in a child seat.

Although many parents know that safety seats are important, more than 80 percent of safety seats can still be misused. Among the most common reasons for incorrect installation of a car seat are: too much space between the vehicle rear seat and the ISOFIX base, twisted or loose safety harness straps in the car seat. It is important to remember that only better education of parents on the proper use of safety seats can save children from potentially fatal crash forces.

## Conclusions

Consumers in the 21st century are surrounded by advertising campaigns promoting various types of safety seats, which are designed to ensure the safety of children while traveling. Manufacturers of child safety seats try to set new trends in safety or material production in such a way as to attract the attention of consumers. It should be noted that a child seat, regardless of how it is installed, its compatibility and integrity with other accessories and its external appearance, must first and foremost be safe. The main purpose of the seat is to ensure the safety of the child in the event of an accident, increasing its chances of survival.

Studies show that more and more people are forgetting the basic function of safety seats, focusing on all other solutions. A survey of 950 people found that about 20% of respondents pay attention to their crash tests and the rating of their child seat. The level of safety of a child seat is taken for granted by many people. Unfortunately, this is not entirely true, as only a small group of safety seats on sale are R129 compliant and have ADAC or TestPlus crash test certificates. In addition, according to the survey data, the most important parameter determining the choice of a car seat for a child according to respondents is the price, mass and method of installation. It should be noted that the parameters determining the choice of a child seat depend on the gender of the respondents. Men are much more likely than women to pay attention to the price of a child seat. And women are more likely than men to be guided by public opinion when choosing a child seat.

Statistical analysis of the collected survey data showed that the purchasing preferences of safety seats are related to the gender of the respondents. In addition, the collected data revealed a social problem consisting in the inability to check and try on the child to the purchased car seat in a passenger vehicle. It's one thing to check if a child seat fits your passenger car. The second, more important point is whether the seat is adapted to the mass and dimensions of the child. In many brick-and-mortar stores, there are stations for testing the comfort of the child in the seat. Unfortunately, with this type of position, there is no way to check if the child will feel comfortable during the journey, we can only check if the child fits the mass and height of the seat. In addition, the results of the survey show that only about 20% of respondents had the opportunity to try on a car seat. This is due to the fact that a large proportion of brick-and-mortar stores do not offer such a service. This is a big mistake, because even the most expensive car seat, if it is poorly installed in a passenger vehicle, will not fulfill the basic role of the child's safety during the journey.

The collected data from the survey indicate a very low percentage of respondents satisfied with the purchased child seat. It should be noted that about 38% of respondents would choose not to buy the same car seat again. Perhaps this is due to the fact that

the child often cries in the car seat during the journey, or the fact that he has learned the exact advantages and disadvantages of having one while using the child seat.

Undoubtedly, the authors believe that the safety of transported children should be a priority when transporting them. Therefore, in order to ensure the safety of the transported children, it is necessary to first choose a seat in terms of the child's mass and height, and then correctly install it in the passenger vehicle.

In further work related to safety seats, the authors will focus on improving the safety and comfort of vibrations transmitted to children placed in safety seats. In addition, the authors will focus on the process of testing approved safety seats, crash testing for displacement of a dummy placed in a child seat, and road tests for vibration from the road surface to the child seat. The authors also intend to examine the influence of age, education, and place of residence on purchasing preferences for safety seats. They will classify the features of child safety seats related to safety and vibration comfort, which parents or legal guardians should pay attention to when purchasing a car seat.

#### BIBLIOGRAPHY

- [1] Active Retract Harness [online], Available at: <https://www.besafe.com.pl/news/wyjasnienie-uprzaz-active-retract-harness> [Accessed: 23 September 2023].
- [2] Bakhurji, E.A., M. Alqahtani, A., M. Alwashmi, E. et al., 2023. Impact of social media campaigns on parents' knowledge, attitudes and practices regarding the use of child car seats in the Gulf region. *BMC Public Health* 23, 1816. DOI: <https://doi.org/10.1186/s12889-023-16742-0>.
- [3] Bilston, L.E., Mills, E., Kent, N., Brown, J., Whyte, T., 2022. Head travel in the event of a frontal collision is smaller in high-back booster seats than in forward-facing child seats with internal harnesses designed for children up to 8 years of age, *Road Injury Prevention*, 23:5, 244-249, DOI: 10.1080/15389588.2022.2048825.
- [4] Britax Römer Baby Safe iSENSE i-Size with base, [online]. Available at: <https://8stars.com/pl/foteliki-samochodowe-0-13-kg-grupa-0/714-fotelik-britax-roemer-baby-safe-isense-i-size-baza.html>, [Accessed: 23 September 2023].
- [5] Brown, J., Elkington, J., Hunter, K., Charlton, J.L., Bilston, L.E., Hayen, A., Keay, L., 2020 Process Evaluation Protocol for Investigating the Impact of Instructions for Proper Use of Child Car Seats, Designed in a Consumer-Led Process and Evaluated in a Randomized Controlled Field Trial. *Int. J. Environ. Res. Public Health*. 17, 4508. <https://doi.org/10.3390/ijerph17124508>.
- [6] Champahom, T., Jomnonkwao, S., Thotongkam, W., Jongkol, P., Rodpon, P., Ratanavaraha, V., 2023. Exploring Parental Attitudes Towards the Use of Child Seats by Comparing Non-Users and Parents of Users. *Sustainability*. 15, 2896. <https://doi.org/10.3390/su15042896>.
- [7] Cornelissen, M., Hermans, M., Tuijl, L., Versteeg, M., van Beeck, E., Kemler, E., 2021. Child safety in cars: an observational study on child seat use in the Netherlands, *Traffic Injury Prevention*, 22:8, 634-639. DOI: 10.1080/15389588.2021.1980562.
- [8] Domenech, D., Parera, N. & Maturana, G., 2018. Comparative protocol study between R44 and I-Size regulations for child restraint systems. *SAE Technical Paper* 2018-36-0124, <https://doi.org/10.4271/2018-36-0124>.



- [9] Dulf, D., Peek-Asa, C., Jurchiș, F., & Bărăgan, E.A., 2020. Use of child restraint systems and seat belts by children in motor vehicles, Cluj-Napoca, Romania. *Injury Prevention*, 26(1), 18-23. <http://dx.doi.org/10.1136/injuryprev-2018-042989>.
- [10] European Road Safety Observatory, [online]. Available at: [https://road-safety.transport.ec.europa.eu/system/files/2022-08/ff\\_children\\_20220706.pdf](https://road-safety.transport.ec.europa.eu/system/files/2022-08/ff_children_20220706.pdf), [Accessed: 23 September 2023].
- [11] Explanation of car seat safety: R129 and R44 [online]. Available at: <https://www.maxi-cosi.pl/c/roznice-miedzy-normami-bezpieczenstwa-r44-i-r129> [Accessed: 23 September 2023].
- [12] Frej, D., Grabski, P., 2019. The effect of an unbalanced rear wheel on the vibration comfort of a child seat. *Transportation Research Process*, 40, 678-685, DOI: <https://doi.org/10.1016/j.trpro.2019.07.096>.
- [13] GUIDE FOR CAR SEAT BUYERS [online]. Available at: <https://www.halfords.com/baby-and-child/buying-guides/car-seats-buyers-guide.html> [Accessed: 23 September 2023].
- [14] Jiang, L., Zhao, M., Lin, H., Yang, L., 2023. How do consumer innovation and consumer value shape users' propensity to purchase innovative car seats? *Sustainability*. 15, 172. <https://doi.org/10.3390/su15010172>.
- [15] Lansdown, T. C., 2012. Individual Differences and Propensity to Engage in Vehicle Distractions – A Self-Report Survey. *Transportation Research Part F: Traffic Psychology and Behavior*, 15(1), 1-8. DOI: <https://doi.org/10.1016/j.trf.2011.09.001>.
- [16] Muszynski, A., Luszczek, J., Szymaniuk, R., 2020. Comparative analysis of safety parameters of child seats in relation to the new Regulation No. 129 of the United Nations Economic Commission for Europe (UNECE). 2, 142-155. DOI: <https://doi.org/10.3390/vehicles2010008>.
- [17] Park, D.D., Yoo, W., 2009. Study the design of a child seat system with multi-point seat belts to enhance safety. *J Mech Sci Technol* 23, 3316–3322. DOI: <https://doi.org/10.1007/s12206-009-0922-2>.
- [18] Penmetsa, P., Adanu, E.K., Lidbe, A., Li, X., Nambisan, S., Jones, S.L., 2023. Relative Safety Rating of Placing Children in Vehicles with Varying Levels of Advanced Safety Technology. *Future Transp.* 3, 615-625. <https://doi.org/10.3390/futuretransp3020036>.
- [19] Posuniak, P., Jaśkiewicz, M., Kowalski, K., Dąbrowski, F., 2018. Child seats: problems related to the safety of children transported in booster seats (without integral seat belts), XI International Scientific and Technical Conference on Automotive Safety, Žasťá, Slovakia. 1-7, DOI: 10.1109/AUTOSAFE.2018.8373352.
- [20] Popa, S., Ciongradi, C.I., Sârbu, I., Bică, O., Popa, I.P., 2023, Bulgaru-Iliescu D. Road accidents in children and adolescents: a comprehensive orthopaedic and medico-legal approach. *Children (Basel)*. 2023 August 24; 10(9):1446. DOI: 10.3390/children10091446.
- [21] REDUCING CHILD FATALITIES ON EUROPE'S ROADS, [online]. Available at: [https://etsc.eu/wp-content/uploads/PIN-FLASH\\_34.pdf](https://etsc.eu/wp-content/uploads/PIN-FLASH_34.pdf), [Accessed: 23 September 2023].
- [22] Tan, R.M.R., Dong, C., Shen, G.Q., Feng, J.X.Y., Piragasam, R., Tyebally, A., Chong, S.L., 2020. Parents' Knowledge and Beliefs About the Use of Child Car Seats in Singapore: A Qualitative Study. *Singapore Med J*. 61(2):102-107. DOI: 10.11622/smedj.2019023. Epub 2019 Feb 18. PMID: 30773603; PMCID: PMC7052007.
- [23] Tellier, B. Le, Pormente, S., Meyer, F., Bourdet, N., Willinger, R., Renaudin, F., 2018. Comparison of two child seats subjected to a regulatory side impact with respect to biomechanical criteria related to the newborn, *International Journal of Crashworthiness*. 23:5, 475-485, DOI: 10.1080/13588265.2017.1345590.
- [24] Why choose a car seat with built-in airbags [online], Available at: <https://www.maxi-cosi.pl/c/dlaczego-warto-wybrac-fotelik-samochodowy-z-wbudowanymi-poduszkami-powietrznymi>, [Accessed: 23 September 2023].

- [25] Xuerong, Z., Xinmei, X., 2022. Studies on child seat side impact performance based on ECE R129 regulations and optimized SIP protection, *International Journal of Crashworthiness*. 27:5, 1521-1531. DOI: 10.1080/13588265.2021.1963555.
- [26] Xuerong, Z., Yanxiao, N., 2022. Studies on the general parameters of the I-SIZE child seat system in the event of a frontal collision, *International Journal of Crashworthiness*. 27:4, 968-978, DOI: 10.1080/13588265.2021.1889219.
- [27] Zaloshnja, E, Miller, T.R., Hendrie, D., 2007. Efficacy of child seats and seat belts for children aged 2 to 3 years. *Arch Pediatr Adolesc Med*. 161(1):65–68. doi:10.1001/archpedi.161.1.65.
- [28] Zhang, X., Gao, J., Tu, W., 2023. Testing of parameters for child booster seats in frontal collisions. *Appl. Sci.* 13, 2206. <https://doi.org/10.3390/app13042206>.
- [29] Zuska, A., Szumska, E., & Frej, D., 2021. Laboratory tests of child seat control using the vibration comfort method for children transported in them. *Communications - Scientific Letters of the University of Zilina*, 23(3), B187-199. DOI: 10.26552/com. C.2021.3.B187-B199.