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ROAD TRAFFIC SAFETY: A CASE STUDY OF THE PILA POVIAT IN POLAND

Summary. Every year, many road accidents occur on Polish roads, in which many people lose their lives and health. Therefore, an attempt was made to analyze road accidents in the Piła poviat. The source of the analysis were the authors' observations and statistical data. This study was conducted on a sample of 250 inhabitants. Hence, a questionnaire was used. Most people, more than half, about 56%, travel by car because it is a more convenient and faster means of transport. While 35% of respondents stated that they feel relatively safe on the roads. A majority, 65%, of the respondents did not participate in a road accident. Further, 60% of the respondents replied that there were many accidents in the Piła poviat, and only 11% answered that there were not many accidents. According to the respondents, the biggest cause of the accidents is alcohol, inattention of drivers and haste. Despite the information, advertisements, scale of these accidents, and opinions of family and friends, people still drive under the influence of alcohol. Year by year, the number of accidents on the roads of the Piła poviat is low, but still considerably high. There is no best way to stop this from happening. In Piła itself, circular intersections have been introduced to improve safety, such an operation is one of the methods for smoother traffic. Additionally, in residential areas, there are more speed bumps to reduce the speed of vehicles. The conclusions

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obtained in this article can be successfully implemented, not only in other cities in Poland but also in Europe as well.

Keywords: road accident, road collision, road traffic safety

1. INTRODUCTION

Road safety depends on many factors [1]. It is determined by the documentation of students' behavior, including the experience of vehicle drivers. Based on these skills, critical road solutions, as well as the design of vehicles can help drivers make decisions in critical situations on the road and reduce the severity of errors. Unfortunately, the life or health of other road users often depends on the decision to become addicted. The development of technology with the language of the road is increasingly aimed not only at mitigating the effects of accidents, but also at avoiding them. Despite modern vehicle control systems that facilitate travel, drivers do not slow down to warnings during transport control. It should be noted that the driver is responsible for the speed at which the vehicle he/she is driving is traveling.

There is a paramount need to consider elements and factors beyond the operator's control, such as weather and other road users, and adjust speed and maneuvers to reduce the likelihood of causing or being involved in an accident or collision.

Organizations such as the National Road Safety Council at the governmental level, the inter-ministerial advisory and the auxiliary body of the Council of Ministers on road safety are responsible for both the observance of policies in this area and the monitoring of road safety conditions [2].

Countries with the highest number of accidents in the world are those where, on average, per 100 000 inhabitants, the most people die each year. These are countries like Namibia (45 people), Thailand (44 people) and Iran (38 people) [3]. This may be due to poor funding for road infrastructure and a very low number of road checks.

The countries with the highest number of accidents in Europe are those where per 100 000 inhabitants per year, the most people are killed in accidents per year. In this category are Romania (10 people), Croatia, Poland and Luxembourg (9 people). The data show that in Europe some of the Balkan and Baltic countries as well as Luxembourg and Belgium have the lowest road safety levels [3]. The reason may be inadequate financing of road infrastructure.

The countries with the lowest number of accidents in the world are the countries with the lowest death toll per 100 000 inhabitants per year. These countries are Maldives (2 people), Tajikistan and Malta (3 people). Based on these data, it can be deduced that the safest roads in the world are in island countries with fewer vehicles. The safest roads in Europe are Germany and Switzerland [3]. This may be due to fewer settlements and vehicles in island cities, while in other countries, it may be better co-financing of road infrastructure.

Annually, the European Union spends around EUR 45 billion on eliminating the effects of road accidents each year. Together with the psychological and health effects as well as compensation for families following the death of a loved one, this sum amounts to EUR 160 billion [4].

When moving along the road, certain rules and regulations must be followed [5]. Many elements contribute to the improvement of road traffic safety related not only to the promotion of the proper behavior of drivers [6-8], but also to the proper organization of traffic, and proper technical condition of roads and vehicles [9-12]. Training and examinations for future drivers should also be considered. Road safety is a scientific field, which covers the above-mentioned aspects, and issues related to traffic supervision, medical rescue and transport psychology [13].

The problem of using the road as a means of transport as related to safety is discussed in [14-16].

2. MATERIALS AND METHODS

This article aims to analyze the state of road safety in the Piła poviat. For this purpose, the first part describes the Piła poviat, analysis of accidents in Poland and Piła poviat, and presents their causes. The source of the analysis were the authors' observations and statistical data. The identification of the main problem was caused by the number of road accidents occurring in the analyzed poviat. This article presents the views of the inhabitants on road safety in the Piła poviat and their approach to this issue. The study was conducted on a sample of 250 inhabitants. Hence, a questionnaire was used. The questions concern the residents' feelings about safety in the poviat, as well as whether they have been involved in a road accident, if so, what caused it, what are the dangerous places in Piła and whether they have ever driven a car under the influence of alcohol. The survey was conducted openly while maintaining the anonymity of the respondents. It was preceded by a preliminary survey to fully understand the questions asked by the respondents.

Among the methods of scientific research applied were the observational method, examination of documents and individual cases, as well as the monographic method. In addition, it was decided to choose the method of diagnostic survey, that is, questionnaire, as it allows people who had contact with the topic to comment.

The survey was conducted among the inhabitants of the Piła poviat to collect information about road incidents in the region and learn about the respondents' opinions on road safety in the poviat.

3. ANALYSIS OF ACCIDENTS IN POLAND AND THE PIŁA POVIAT

The Piła poviat is located in the northern part of the Greater Poland Voivodeship (formerly in the Piła Voivodeship), on an area of 1 268 km^2, inhabited by approx. 406 147 inhabitants (data from the end of 2020). The Piła poviat is one of the five land poviats, which were established on the territory of the former Piła voivodeship, and currently belongs to the Wielkopolskie voivodeship with the capital in Poznań. Figure 1 shows the location of the Piła poviat in Greater Poland.

The Piła poviat is located on route No. 10, connecting Szczecin with Warsaw, and on route No. 11, connecting Kołobrzeg with Bytom. The poviat has a well-developed railway infrastructure and a network of railway connections with major cities in Poland. The road network in the district consists of generally accessible public roads, which are divided into the following categories:

- national roads with a total length of 92 km,
- voivodeship roads with a total length of 88,5 km,
- poviat roads with a total length of 428,8 km,
- commune roadswith a total length of 512,2 km.

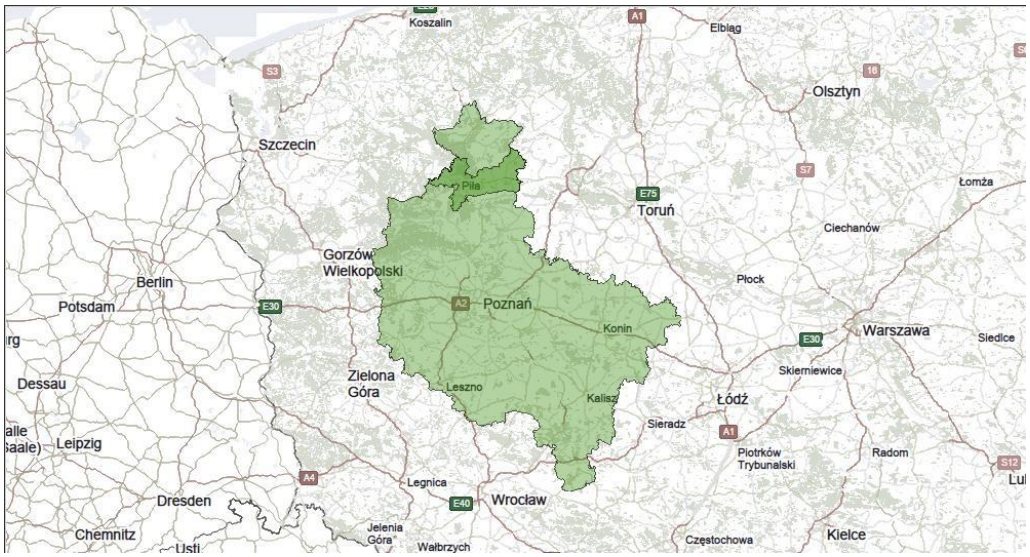

Fig. 1. Location of the Piła poviat in Greater Poland [17]

Based on the police data (Table 1), it can be concluded that in the years 2006-2020, there were 5 867 367 collisions in Poland, 561 315 accidents, 56 118 people died, and 690 648 were injured. In the same period, there were 19 098 collisions in the Piła poviat, 1 511 accidents, 219 people were killed and 1 983 were injured. Compared to Poland, the Piła poviat is at the level of 0,33% of road accidents occurring in Poland. The number of fatalities at the level of 0,38% in Poland is significantly different from this value.

Tab. 1

Number of road incidents and accidents in Poland and the Piła poviat in 2006-2020 [18]

Year	POLAND				PIŁA REGION				PERCENTAGE SHARE OF THE PILA REGION IN EVENTS IN POLAND			
	Number of accidents	Number of killed	Number of injured	Number of collisions	Number of accidents	Number of killed	Number of injured	Number of collisions	Number of accidents	Number of killed	Number of injured	Number of collisions
2006	46 876	5 243	59 123	411727	134	22	168	1407	0,29%	0,42%	0,28%	0,34%
2007	49 536	5 583	63 224	386 934	161	22	201	1412	0,33%	0,39%	0,32%	0,36%
2008	49 054	5 437	62 097	381 520	159	23	220	1480	0,32%	0,42%	0,35%	0,39%
2009	44 196	4 572	56 046	381 769	134	17	183	1283	0,30%	0,37%	0,33%	0,34%
2010	38 832	3 907	48 952	416 075	110	12	150	1372	0,28%	0,31%	0,31%	0,33%
2011	40 065	4 189	49 501	366 520	122	24	156	1253	0,30%	0,57%	0,32%	0,34%
2012	37 046	3 571	45 792	339 581	128	6	188	1122	0,35%	0,17%	0,41%	0,33%
2013	35847	3357	44059	355943	116	14	168	1110	0,32%	0,42%	0,38%	0,31%
2014	34970	3202	42545	348028	106	14	132	1017	0,30%	0,44%	0,31%	0,29%
2015	32967	2938	39778	362265	75	8	95	1114	0,23%	0,27%	0,24%	0,31%
2016	33664	3026	40766	406622	85	19	122	1235	0,25%	0,63%	0,30%	0,30%
2017	32760	2831	39466	436469	56	12	66	1337	0,17%	0,42%	0,17%	0,31%
2018	31674	2862	37 359	436414	47	12	48	1335	0,15%	0,42%	0,13%	0,31%
2019	30 288	2 909	35 477	455454	44	9	52	1416	0,15%	0,31%	0,15%	0,31%
2020	23 540	2 491	26 463	382046	34	5	34	1205	0,14%	0,20%	0,13%	0,32%
Sum	**561 315**	**56 118**	**690 648**	**5 867 367**	**1 511**	**219**	**1 983**	**19 098**	**-**	**-**	**-**	**-**
Average	**37 421**	**3 741**	**46 043**	**391 158**	**101**	**15**	**132**	**1 273**	**0,26%**	**0,38%**	**0,27%**	**0,33%**

According to the data of the Statistical Office in Poznań, the number of vehicles in the Piła poviat increased by 33% from 2010-2019. In 2010, the number of registered vehicles was approximately 83 711, while in 2019 it was 111 964. Detailed data are presented in Table 2. In Table 2, it can be seen that an average 1% of vehicles registered in the poviat are annually involved in road incidents in the Piła poviat.

Tab. 2

Number of registered vehicles in the Piła poviat, number of road incidents in the Piła poviat, percentage of vehicles involved in road incidents [19, 20]

Year	Number of registered vehicles:	Number of road incidents:	Percentage of registered vehicles that were involved in road incidents:
2010	83 711	1 372	1,64%
2011	87 243	1 253	1,44%
2012	91 299	1 122	1,23%
2013	93 060	1 110	1,19%
2014	95 537	1 017	1,06%
2015	97 979	1 114	1,14%
2016	101 153	1 235	1,22%
2017	105 053	1 337	1,27%
2019	108 386	1 335	1,23%
2019	111 964	1 416	1,26%
Average:	**97 539**	**1 231**	**1,27%**

4. RESULTS

A total of 48% of men and 42% of women participated in this study. The highest percentage of respondents, 40%, comes from the age group of 21-30 and over 51, which is 20%. People aged up to 20 and 41-50 are the least numerous. The above data are presented in Figure 2. Among the surveyed women, women aged 21–30 and over 51 were the largest groups, while women aged 31-40 were the smallest. The most numerous group of respondents were men aged 21-30, and the least numerous were aged 41-50. These data are included in Table 3. Majority of the respondents, 67%, live in Piła and 33% in the surrounding towns.

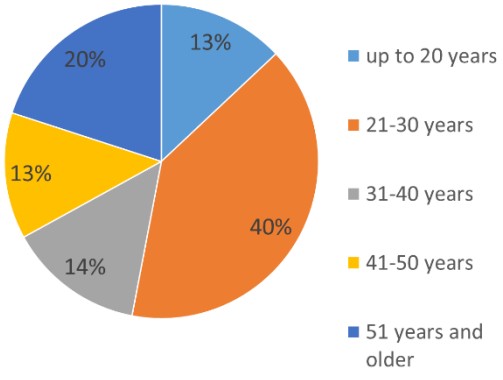

Fig. 2. Age of respondents

Tab. 3

Age of respondents by gender

Age	Woman	Man
up to 20 years	17,02%	9,09%
21-30 years	27,66%	52,27%
31-40 years	12,77%	15,91%
41-50 years	19,15%	6,82%
51 years and older	23,40%	15,91%

Most people, more than half, travel by car, 56%, as it is a more convenient and faster means of transport. While 29% move on foot. Only 15% of respondents choose public transport. Considering age and gender, men most often choose the car as their main means of transport. The exception is men up to the age of 20, who mainly use public transport. Similarly, women, like men, mainly choose the car as a means to their destination, however, women under 20, choose the foot as a means to their destination, as opposed to men who choose public transport. The above data is presented in Figure 3.

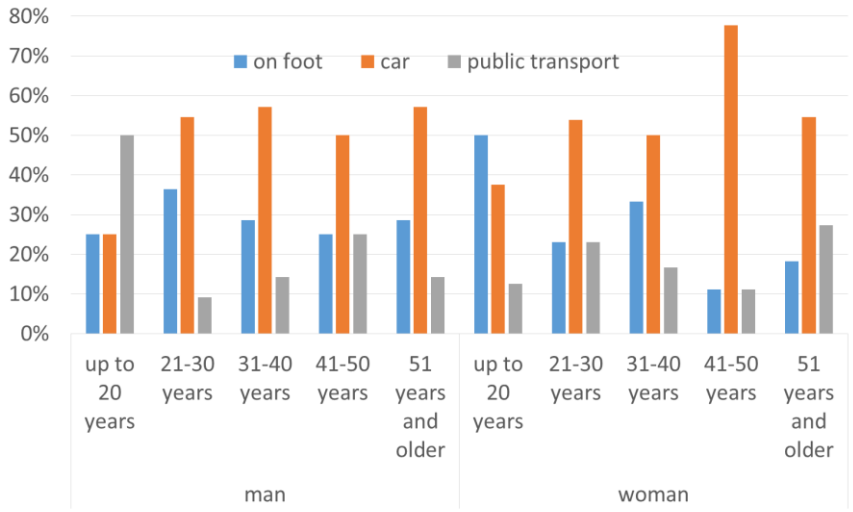

Fig. 3. Age of respondents depending on the chosen mode of movement

To the next question: How do you feel on the roads? Most of the respondents declared that they feel relatively safe on the roads of the Piła poviat; they constitute 35%. A little less, 30% said they felt relatively safe. However, 12% feel unsafe and 4% very dangerous. While 3% of the respondents move safely. People who do not have an opinion or are indecisive are 3%. Analyzing the data presented in Figure 4, it can be concluded that men aged up to 20 (50%) and 21-30 (44%) and women over 51 (45%) feel relatively safe on the roads. Among men, the level of safety decreased with age. Men aged 31-40 (29%) and women aged 41-50 (11%) feel the least safe. It is worth noting that none of the respondents feels safe on the roads. The situation is similar for women over 31 (Figure 5).

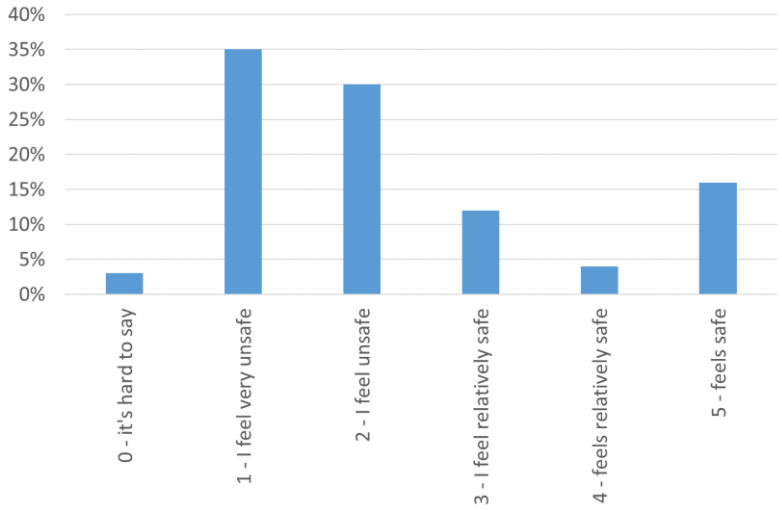

Fig. 4. Security level of respondents

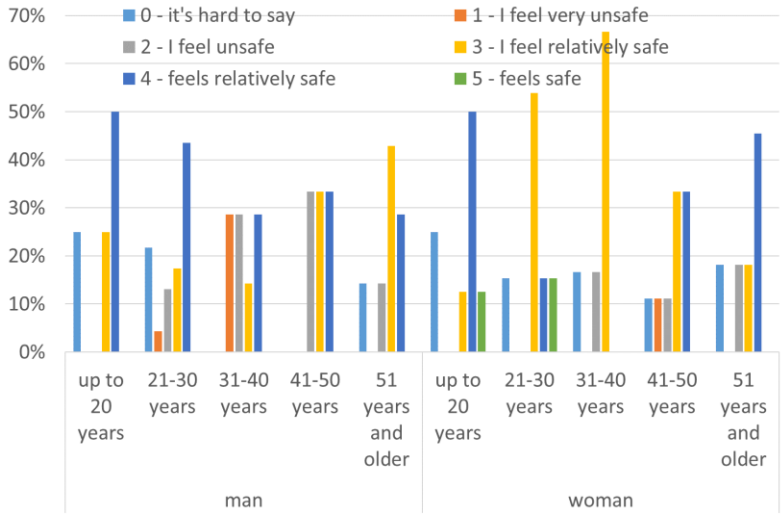

Fig. 5. The feelings of the respondents depending on gender and age

In the next question, the respondents answered whether they had been involved in road accidents. Most of the respondents, 65%, have not been involved in a road accident in the Piła poviat. On the other hand, 37% of the respondents have been involved in a road accident. The data shows that most of the respondents have not been involved in a road accident, this may be because almost half of the respondents are 18-30 years old who have recently obtained a driving license, and according to police data, the number of accidents in the Piła poviat is progressively lower from one year to another. Most of the men aged 31-40 (71%) and 41-50 (67%) have been involved in road accidents. In women, these values are much lower and constitute 37% for women aged 41-50 and 33% for women over 51 years of age. These are disturbing numbers. The data is presented in Figure 6. People who answered yes to this question stated that nearly 55% of them have been involved in a road accident with another vehicle. Cyclists were responsible for 25% of accidents and pedestrians 17%. The surveys took place in different years; most of them took place in 2011-2020, largely in Piła.

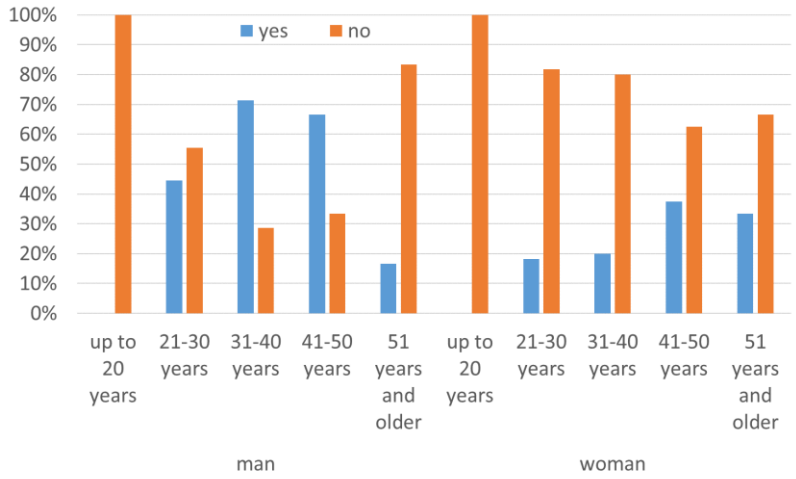

Fig. 6. Share of respondents in road accidents by gender and age

To the next question: Are there many accidents in the Piła poviat? More than half, as many as 60% of the respondents replied that there have been many accidents in the Piła poviat, and only 11% answered that there were not many accidents. However, 22% did not have an opinion on the subject. This question was answered in the affirmative by most of the men aged 41–50 (67%) and women aged 21-30 (73%). Those with no opinions on the subject were mostly men aged up to 20 (67%) and women aged 41-50 (38%). This may indicate that they have not had contact with such a situation before. The above data is presented in Figure 7. According to 60% of the respondents, most accidents occurred in recent years, that is, 2016-2020. The farther away, the lesser the accidents. In 2011-2015 - 30%, in 2006-2010 - 7%, in 2000-2005 - 3%.

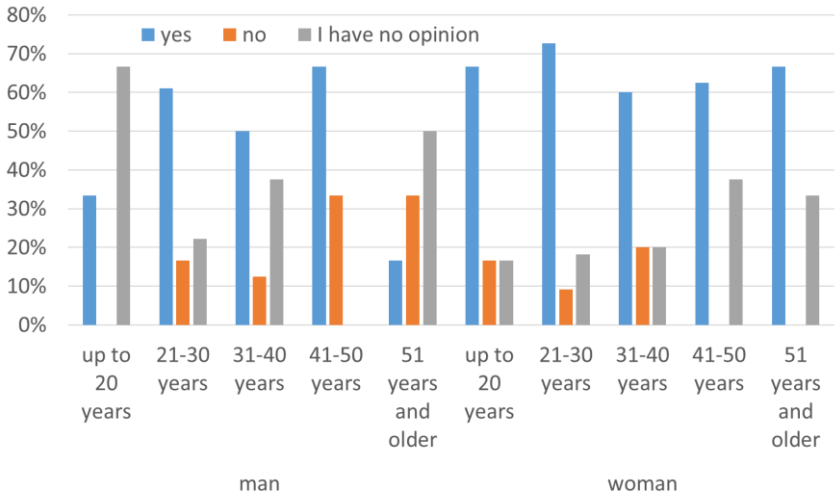

Fig. 7. Respondents' opinions on road accidents by gender and age

Almost 51% of respondents indicated the answer "haste, inattention, overzealous drivers" as the cause of the high number of road accidents. Thus, the drivers themselves are mostly to be blamed because they are in a hurry, distracted, unthoughtful and feeling very unwell. The next positions are bad road surface (20%), alcohol (14.7%) and bad signage (2.7%). It was difficult for 12% of respondents to answer this question. Men indicated haste, inattention and overzealous drivers as the most important reasons. This is especially true for men aged 51 and

over (67%) and 21-30 (56%). According to women, as in the case of men, the main causes of road accidents were "haste, inattention, overzealous drivers", especially in the group over 51 years of age, where this choice was chosen by nearly 78% of the respondents. Surprisingly, nearly 30% of men aged 31-40 and 50% of women under 20 do not know the answer to the question about the cause of road accidents. The above data is presented in Figure 8.

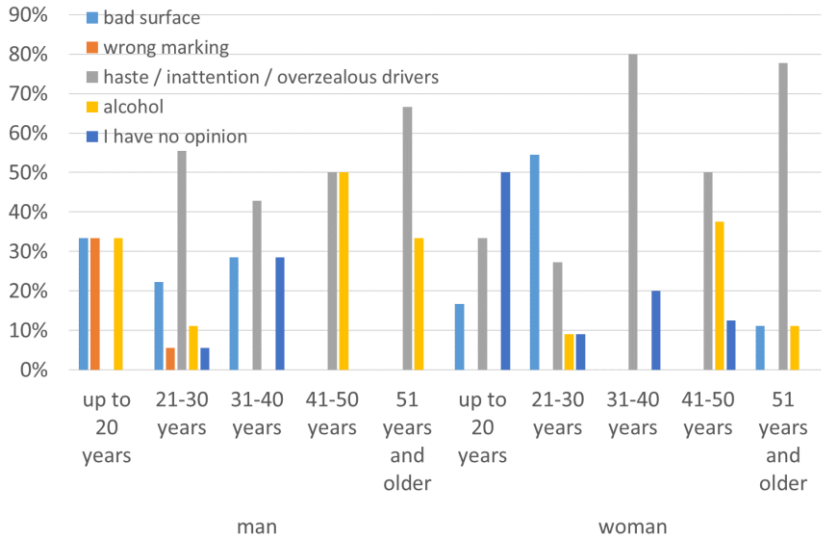

Fig. 8. Accident reasons by gender and age of respondents

In the next question, the respondents had the opportunity to indicate dangerous streets in the analyzed city. Mainly two-lane streets in the city were indicated. Police data are similar to the answers given by the respondents [18].

The respondents then identified how often they use their mobile phones while driving. Most people said they did not use the phone while driving, 39% and 22% said they do not use it "hardly at all". Worryingly, however, 14% use the phone frequently and 25% occasionally while driving, which makes driving more dangerous. Given the detailed data, it can be concluded that 43% of men aged 21-30 and 25% of men aged 31-40 and 50% of women under the age of 20 frequently use their phones while driving. Particularly, this group should be focused on preventive actions in this regard. The above data is presented in Figure 9.

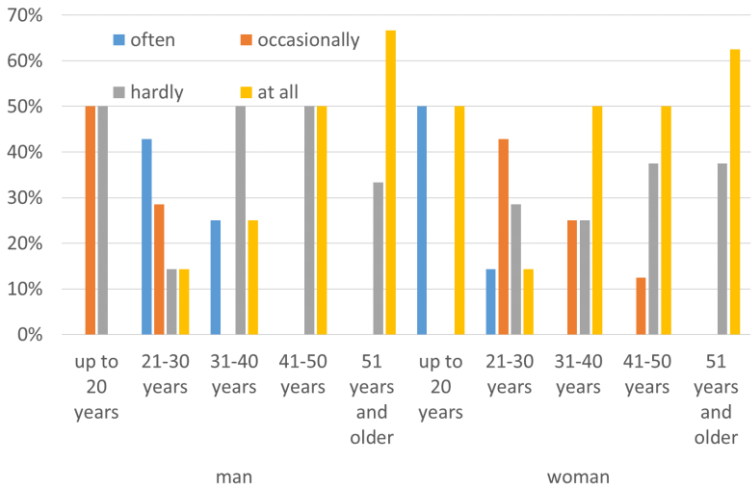

Fig. 9. People using the phone while driving a car

According to more than half of the respondents, 53%, think that the age range in which drivers commit the most accidents is 21-30 years old. The second place is taken by drivers aged 18-20, 31%, and the third is the oldest, 51-year-old and over, 7%. This is consistent with the Police data, as the age of the people who cause the most accidents (21-30 years old) and the perpetrators who cause the least accidents (41-50 years old). In the analyzed case, people of this age constitute 4% [18].

To the next question: Has anyone around you (relatives, friends) ever been drunk driving? As many as 33% of the respondents gave an affirmative answer, which means that a large number of drivers believe that they can drive a car after drinking alcohol, 30% of the respondents gave a negative answer. This concurs with the police data, showing that the problem with drunk drivers is still active despite the passage of time and that preventive action should be continued [18].

To the last question: has anyone around you (relatives, friends) lost his/her driving license? In the Piła poviat, many people have lost their driving license due to speed, drunk driving or other circumstances.

5. CONCLUSIONS

Road accidents and road collisions are serious problems. Despite the passage of time and the improvement of the quality of roads, as well as modern vehicles, they occur relatively often. However, the greatest fault lies with man, because even with the perfect car and the best road a 100% road safety is not guaranteed. According to the respondents, the biggest cause of accidents is alcohol, inattention of drivers and haste. Despite the information, advertisements, scale of these accidents, and the opinions of family and friends, people still drive under the influence of alcohol. Year by year, the number of accidents on the roads of the Piła poviat is low, but still considerably high. There is no best way to stop this from happening. In Piła itself, circular intersections have been introduced to improve safety, such an operation is one of the methods for smoother traffic. Additionally, in residential areas, there are more speed bumps to reduce the speed of vehicles. Nevertheless, the Piła poviat itself does not rank well in comparison with other poviats in Poland when compared to the Śląskie and Białystok voivodeships, especially the first with the highest number of road accidents, collisions and incidents in Poland. The respondents also focused on drivers who drive on the so-called Memory, which means that they are used to what will happen to them on a given route and what signs appear on it. The bypass running east of Piła is considered a great convenience, thanks to which drivers do not have to pass through Piła while on the road. Despite the passage of time, the inhabitants of the Piła poviat complain about the DK10 and DK11 roads and the intersection of these roads. This is a problem that the services and the rulers are working on. It is possible to predict the site of an accident in the future, although these methods are not foolproof or reliable. Based on where many road accidents have occurred in the past, at what times, and at what seasons of the year, it can be determined whether an accident will occur under these conditions. Modernization and reconstruction of these roads reduce the number of road collisions. The average number of incidents shows that the most frequent accidents occur in the afternoon and evening hours, at the end of the week, in winter months, with good weather conditions.

In 2022, the European Union law on modern safety systems, which every car should have, would become effective. Due to these systems, not only the driver but also the vehicle, will observe road situations, road signs and even monitor the driver's driving behavior.

The number of vehicles on the road is increasing yearly, which results in less smooth journeys, traffic jams and a greater chance of a road accident. More people are choosing to travel by car using public transport. Access by public transport is economical, ecological, and also limits traffic on the roads, as well as reduce the risk of road accidents.

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