

Firearm-related Hunting Accidents in Croatia: (Perceived) Causes and Consequences

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ABSTRACT

Hunting is one of the oldest human activities. While it historically served as a source of food and other resources, in modern society it has evolved into a significant economic activity. Croatia possesses favourable conditions for the development of hunting tourism, owing to its rich natural resources and widespread interest in hunting. However, the extent and manner in which safety measures are implemented to prevent hunting accidents remain insufficiently explored. To address this research gap, a survey was conducted among 338 hunters in Croatia. The results indicate a relatively high level of awareness among hunters regarding potential accidents, and that safety measures are mostly practiced. Additionally, the study examined differences in attitudes toward hunting safety between less experienced and more experienced hunters. Hunting experience was operationalised using two indicators: the number of hunting trips undertaken by respondents in the past year and the total number of years of hunting activity. Statistical analysis was performed using the chi-square test. Statistically significant differences were found in six out of 17 survey items, primarily between more frequent and less frequent hunters. To improve hunting safety and prevent future accidents, the majority of the respondents recommended more intensive education and training for hunters.

Keywords: safety; hunting; accidents; hunting tourism; Croatia

INTRODUCTION

Hunting is one of the oldest human activities practiced throughout history. In the past, hunting was an important source of food, clothing made from the skins of hunted animals, tools and decorations made from the bones and other parts of hunted animals (Tomljanović et al. 2016). Today, hunting represents a significant economic sector contributing through the production of game meat and trophies, as well as hunting-related tourism activities (Kupren and Hakuć-Błażowska 2021). Croatia has highly favourable conditions for the development of hunting tourism. In addition to a longstanding tradition of hunting and hunting-related tourism (Kovačević and Kovačević 2006), the country possesses numerous natural advantages, including fertile agricultural land, abundant wildlife populations, significant geographical biodiversity (Sudarić et al. 2022), well-preserved natural environment, and pleasant climate (Milojica et al. 2014). Interest in hunting in Croatia is considerable. According to the Croatian Bureau

of Statistics, 68,292 hunters were registered in 2023, which is a 4.4% increase compared to 2022 (Croatian Bureau of Statistics 2024). With one hunter per 65 inhabitants, Croatia has the highest hunter density among Central and Eastern European countries (Deutscher Jagdverband 2024). Most Croatian hunters hunt quite intensively: a survey conducted by Sudarić et al. (2022) in eastern Croatia found that 78.6% of respondents go hunting once a week, and 9.3% hunt daily. The potential to attract foreign tourists should also be taken into account, especially considering the large number of hunters in neighbouring countries, such as Italy (533,000 hunters), Austria (118,000), and Hungary (55,000) (Deutscher Jagdverband 2024).

Despite its recreational and economic value, hunting raises increasing safety concerns. Hunting is described a “potentially dangerous sport” (Stueland et al. 1995: 196) and hunting accidents resulting in injury or death can arise from various causes, including firearms, falls from height, attacks by wild animals, and other factors (Özsoy et al. 2022). Factors that can influence the occurrence of

hunting accidents are a large number of armed persons in a (relatively) small area, unpredictable weather conditions, hunter excitement and anxiety, uneven terrain and human error (Lambrecht and Hargarten 1993). Falls from trees or tree stands are among the most common causes of hunting-related injuries and fatalities (Zilkens et al. 2011, Özsoy et al. 2022). Loder and Farren (2014) note that more scientific publications have addressed falls from trees or stands than firearm-related accidents. Firearm-related hunting accidents have received limited attention in the scientific literature (Therbo and Von der Osten 2009, Loder and Farren 2014), especially compared to firearm accidents in urban settings (Carter 1989). The proportion of hunting-related firearm accidents in the total number of firearm accidents varies widely in the literature, ranging from 7 to 60% depending on geographical and cultural factors (Karger et al. 2002). Although this type of accident is not as common as firearm accidents in urban areas, they may have a notable impact on hunting communities and can represent a considerable portion of firearm injuries in certain countries (Carter 1989).

Most of the studies analysing this topic refer to the USA (Cole and Patetta 1988, Carter 1989, Lambrecht and Hargarten 1993, Stueland et al. 1995, Cina et al. 1996, Cherry et al. 2001, Decker 2004, Smith et al. 2005, Reihus 2007, Halanski and Corden 2008, Loder and Farren 2014, Holsman et al. 2016, Guetschow et al. 2018). In European countries, studies have been conducted in Sweden (Örnehult and Eriksson 1987, Junuzovic and Eriksson 2012, Junuzovic et al. 2013), Denmark (Therbo and Von der Osten 2008, 2009), Germany (Karger et al. 1996, Zilkens et al. 2011, Schwarz et al. 2021), Switzerland (Bestetti et al. 2015) and Serbia (Gačić et al. 2015). Among other countries, studies have been conducted in Turkey (Özsoy et al. 2022), Canada (McRae 1989) and Cameroon (Bahebeck et al. 2005). In Croatia, only one study on hunting accidents has been published so far (Pintur et al. 2008).

Studies typically differentiate between two main outcomes of firearm-related hunting accidents: injuries and fatalities. In general, the number of fatalities resulting from hunting accidents is low (Karger et al. 1996, Junuzovic et al. 2013, Schwarz et al. 2021) and varies by country. In Germany, 257 hunting firearm accidents were recorded between 1961 and 1992, and in 86 accidents (26%) the injuries were fatal (Karger et al. 1996). From 2000 to 2009, only 85 firearm injuries occurred among 8,563 hunting accidents (0.99%), with 11 fatalities (12.9%), corresponding to an annual death rate of 1.1 per 350,000 hunters (Zilkens et al. 2011). In the U.S., between 1983 and 1986, 860 deaths and 5,727 injuries occurred, with 34% being self-inflicted (Carter 1989). Between 1993 and 2008, 35,970 emergency visits were recorded due to hunting-related firearm injuries, with a fatality rate of 0.6%. The injury rate was 0.1666 per 1,000 hunters per year, with 85% of injuries being self-inflicted (Loder and Farren 2014). In Sweden, from 1970 to 1982, 47 out of 79 firearm deaths (59.5%) were hunting-related. This declined to 48 deaths (1.9 annually) from 1983 to 2008, or 53% of all unintentional firearm deaths (Junuzovic and Eriksson 2012). In Serbia, between 2004 and 2015, a total of 25 firearm-related hunting accidents were reported: 14 of them were fatal and 11 non-fatal, resulting in an average of two deaths per year among approximately 75,000 registered hunters (Gačić et al. 2015).

The only study conducted in Croatia on this subject, by Pintur et al. (2008), analysed injuries and fatalities among members of the Croatian Hunting Association during the period from 1999 to 2006. A total of 152 injuries and 27 fatalities were recorded. The most common causes of injury were falls, including falls from elevated positions, which accounted for 76.3% of all cases. Most fatalities were caused by firearms: in 14 cases (51.1%), the victim was accidentally shot by another hunter, while 3 deaths (11.1%) resulted from self-inflicted gunshot wounds. It can therefore be concluded that during this period an average of 3.37 people died annually while hunting (out of 62,000 hunters) and 17 people died from firearm injuries, which corresponds to an average of 2.12 deaths per year. It should be noted that the fatality rate among Croatian hunters appears to be higher than in several other countries when adjusted for the number of hunters: in Serbia, there was an average of 2 deaths annually among 75,000 hunters; in Sweden, 1.9 deaths among 156,000 hunters; and in Germany, 1.1 deaths among 350,000 hunters. However, such comparisons should be interpreted with caution, since not all registered hunters actively participate in hunting, and many may own firearms without regular field engagement. Additionally, in countries with lower population density, the number of hunters per hectare is often lower, which reduces the likelihood of close contact and potential injury during hunting activities.

Since firearm injuries are the leading cause of fatal hunting accidents in Croatia, and the number of such fatalities is higher compared to other countries, the primary aim of this paper is to explore the hunters' perceptions of the causes and consequences of firearm-related accidents during hunting. A secondary aim is to examine whether there are statistically significant differences in attitudes between more experienced and less experienced hunters, based on the assumption that greater experience may be associated with a more cautious and responsible approach to hunting. In this study, hunting experience is operationally defined by two indicators: the number of hunting trips undertaken by respondents in the past year and the number of years they have been engaged in hunting.

MATERIALS AND METHODS

Data Collection

Data for this study were collected using a questionnaire specifically developed for the purposes of this research. The questionnaire was administered online via Google Forms and was available to potential respondents from mid-November 2024 to mid-January 2025. Participants were provided with clear instructions indicating that the questionnaire was intended solely for scientific research, and that participation was voluntary and anonymous. Potential respondents were contacted via publicly available email addresses found on the websites of hunting clubs. Sampling was conducted nationwide across the Republic of Croatia using a purposive (judgmental) sampling method. Due to the specific nature of the target population, random sampling was not feasible. The authors assessed that the selected respondents were appropriate for the study and adequately represented the population relevant to the phenomenon under investigation (see Vranešević 2014).

Questionnaire Design

The questionnaire consisted of 29 questions. Some items were adapted from previous studies, including those by Karger et al. (1996), Therbo and Von der Osten (2008, 2009), Junuzovic et al. (2013), and Sudarić et al. (2022). The first section included seven questions related to respondents' demographic characteristics, such as age, gender, and education, as well as their general interest in hunting. The remaining questions were organised into five thematic categories: hunting behaviour (7 questions), firearm-related behaviour (4 questions), health status (3 questions), involvement in firearm-related accidents (5 questions), and preventive measures (3 questions).

Questions concerning the respondents' hunting interest and engagement were used to assess differences in attitudes based on hunting experience. Hunting experience was operationalised using two indicators: the number of hunting days in the past year and the total number of years of hunting activity. For the number of hunting days, respondents were divided into two groups: less active hunters, who had hunted fewer than 10 times in the previous year ($n = 50$), and more active hunters, who had hunted more than 10 times ($n = 288$). Respondents were also categorised according to their hunting experience: those with fewer than 10 years of experience were classified as less experienced hunters ($n = 64$), while those with more than 10 years were considered more experienced ($n = 274$).

Data Analysis

The questionnaire included closed-ended questions, where respondents could select only one of the predefined answer options. The data obtained from these questions were treated as categorical variables. A total of 338 valid responses were collected, which was considered a sufficient sample size for conducting appropriate statistical analyses. To examine statistically significant differences between respondent groups, the chi-square test was applied, using a significance threshold of $p < 0.05$. All statistical analyses were conducted using IBM SPSS Statistics, version 23.

RESULTS AND DISCUSSION

Demographics

Özsoy et al. (2022) note that hunting is predominantly a male activity globally, with men comprising the majority of participants in both hunting and hunting-related accidents. In the present study, 95.27% of respondents were male and 4.73% female. Similar gender distributions have been reported in other studies on hunting-related firearm incidents: in Sweden, 95% of respondents were male and 5% female (Junuzovic et al. 2013), while in Denmark, only 1% of participants were female (Therbo and Von der Osten 2009).

The age of the respondents in our study ranged from 22 to 77 years. Notably, no participants under the age of 22 were recorded, although Croatian legislation permits individuals aged 18 and over to engage in hunting activities. Given the online format of the survey, a higher representation of younger participants might have been expected. Nevertheless, the mean age was 46.86 years

($SD = 12.26$), which is slightly lower than that reported in comparable surveys conducted in Denmark (mean age = 49.5 years) and Sweden (mean age = 54 years) (Therbo and Von der Osten 2009; Junuzovic et al. 2013). Regarding educational attainment, the largest proportion of the respondents (48.22%) had completed secondary education, aligning with the general population structure in Croatia, where 55.53% of individuals have attained the same level of education (Živić et al. 2024).

The respondents' engagement in hunting activities is reflected in the frequency of their participation: in the past year, 85.21% of the respondents reported going hunting more than 10 times, and 48.52% reported more than 30 hunting trips. These findings indicate a high level of hunting activity, which exceeds the results from a Danish study in which 70% of the respondents hunted more than 10 times annually (Therbo and Von der Osten 2008, 2009). Regarding hunting experience, the respondents were relatively evenly distributed across different durations of hunting activity. The largest group (29.59%) had been hunting for 10 to 20 years, while 23.08% had over 30 years of experience. Comparable data from a Croatian study showed that 73.1% of the respondents had been hunting for more than 11 years, and 14.2% for more than 30 years (Sudarić et al. 2022). In Sweden, 40% of hunters had more than 30 years of experience (Junuzovic et al. 2013). Most participants in our study reported hunting both small and big game. The primary motivation for hunting, cited by 56.80% of the respondents, was enjoyment of nature. This finding contrasts slightly with that of Sudarić et al. (2022), where socialising was the most frequently reported motive among hunters in eastern Croatia, followed by enjoyment of nature. In both studies, trophies and meat were the least cited reasons for hunting.

Hunting Behaviour

Respondents were concerned to some extent about their own safety and the safety of others when hunting. Only 11.83% of the respondents stated that they had never been concerned about their own safety and the safety of others when hunting, which is less than in a study conducted by Therbo and Von der Osten (2008) in Denmark, in which 30% of the respondents stated that they had never been concerned about their own safety and the safety of others when hunting. A statistically marginal difference was observed between respondents with less than 10 years of hunting experience and those with more than 10 years ($p = 0.051$). This difference appears to stem from the fact that more experienced hunters expressed a slightly higher level of concern for their own safety as well as the safety of other participants in the hunt.

The use of high-visibility clothing is widely recognised as an important factor in improving hunting safety. A study from North Carolina reported that, prior to the introduction of the Hunter Orange law, 35% of firearm-related hunting fatalities occurred because hunters were mistaken for game animals. Four years after the law mandated the use of high-visibility clothing, this proportion decreased significantly to 8.3% (Cina et al. 1996). The majority of the respondents (87.57%) reported always wearing high-visibility clothing and actively avoiding camouflage clothing, which 66.27% of

Table 1. Demographic and behavioural characteristics.

Variable	Number (f)	Percentage (%)
Gender		
Male	322	95.27
Female	16	4.73
Age		
18 - 29 years	30	8.88
30 - 39 years	60	17.75
40 - 49 years	112	33.14
50 - 59 years	82	24.26
60 years and above	54	15.98
Education		
Primary school	3	0.89
Secondary school	163	48.22
Undergraduate	54	15.98
Graduate	82	24.26
Postgraduate	36	10.65
How often did you go hunting last year?		
Less than 10 times	50	14.79
10 - 19 times	69	20.41
20 - 29 times	55	16.27
More than 30 times	164	48.52
How long have you been hunting?		
Less than 10 years	64	18.93
10 - 19 years	100	29.59
20 - 29 years	96	28.40
More than 30 years	78	23.08
What game do you hunt?		
Small game	21	6.21
Big game	56	16.57
Both	261	77.22
What is your main motive for going hunting?		
Socialising	86	25.44
Trophies	24	7.10
Enjoyment of nature	192	56.80
Other	36	10.65

the respondents stated they never wear. In Denmark, 57% of hunters reported consistent use of high-visibility clothing (Therbo and Von der Osten 2008), while in Sweden this proportion was even higher, at 98% (Junuzovic et al. 2013). However, Swedish hunters also reported considerable use of camouflage clothing: 50% when hunting alone and 40% when hunting with others.

Despite the evident risks to hearing and eye safety, the use of personal protective equipment such as ear protection and goggles remains limited. In our study, only 2.07% of the respondents always used both goggles and headphones, and 4.73% used them often, whereas 64.50% reported never using them. These findings align with data from Denmark,

where 78% of hunters never used ear protection and 82% never used goggles (Therbo and Von der Osten 2008).

Alcohol has been extensively studied in the literature as it is a factor that significantly contributes to the commission of homicide by increasing aggression and decreasing the ability to control behaviour (Carcach and Conroy 2001, Žarković Palijan et al. 2009, Draganić et al. 2016). In the context of hunting, alcohol consumption also raises serious safety concerns. In our study, 46.75% of the respondents reported never consuming alcohol before, during, or after hunting. Statistically significant differences were found ($p = 0.006$) between respondents who went hunting less than 10 times in the past year and those who went hunting

Table 2. Hunting behaviour.

Question	Number (f)	Percentage (%)	Days hunting				Years hunting			
			<10	>10	χ^2	p	<10	>10	χ^2	p
I am concerned for my own safety and/or the safety of other hunters while hunting:										
Always	70	20.71	8	62			10	60		
Often	34	10.06	7	27			7	27		
Sometimes	104	30.77	12	92	26.269	0.393	21	83	31.354	0.051
Rarely	90	26.63	15	75			20	70		
Never	40	11.83	8	32			6	34		
I wear high visibility clothing when hunting:										
Always	296	87.57	45	251			60	236		
Often	31	9.17	5	26			3	28		
Sometimes	8	2.37	0	8	14.643	0.066	1	7	18.249	0.250
Rarely	2	0.59	0	2			0	2		
Never	1	0.30	0	1			0	1		
When I hunt with other hunters, I wear camouflage:										
Always	51	15.09	11	40			11	40		
Often	16	4.73	3	13			4	12		
Sometimes	13	3.85	3	10	27.174	0.347	4	9	29.488	0.244
Rarely	34	10.06	6	28			6	28		
Never	224	66.27	27	197			39	185		
I use safety goggles and/or hearing protection when hunting:										
Always	7	2.07	1	6			0	7		
Often	16	4.73	1	15			3	13		
Sometimes	36	10.65	4	32	35.565	0.780	9	27	19.744	0.232
Rarely	61	18.05	10	51			10	51		
Never	218	64.50	34	184			42	176		
I consume alcohol before, during or after hunting:										
Always	5	1.48	2	3			1	4		
Often	10	2.96	2	8			4	6		
Sometimes	49	14.50	9	40	46.276	0.006	8	41	20.942	0.969
Rarely	116	34.32	16	100			17	99		
Never	158	46.75	21	137			34	124		
I go hunting even though I drank a large amount of alcohol the day before:										
Always	6	1.78	0	6			1	5		
Often	1	0.30	0	1			0	1		
Sometimes	20	5.92	5	15	15.572	0.411	6	14	20.050	0.455
Rarely	80	23.67	10	70			18	62		
Never	231	68.34	35	196			39	192		
I will go hunting despite the poor visibility:										
Always	11	3.25	2	9			2	9		
Often	13	3.85	1	12			5	8		
Sometimes	71	21.01	6	65	30.296	0.213	10	61	36.651	0.062
Rarely	125	36.98	19	106			23	102		
Never	118	34.91	22	96			24	94		

more frequently, i.e. more than 10 times. Furthermore, after consuming a large amount of alcohol the day before, 68.34% of the respondents never go hunting, and 5.92% of the respondents said they sometimes do so. This is slightly less than in Sweden, where 9% of the respondents stated that they sometimes go hunting the day after consuming a large amount of alcohol (Junuzovic et al. 2013).

Poor visibility represents an important risk factor in hunting-related firearm accidents. According to Article 7 of the Croatian Ordinance on the Use of Hunting Weapons and Ammunition (Official Gazette 37/19), the use of hunting weapons and ammunition is prohibited in conditions of poor visibility caused by adverse weather conditions such as precipitation, fog, or strong wind. In our study, 21.01% of the respondents stated that they sometimes go hunting in conditions of poor visibility, 36.98% reported doing so rarely, and 34.91% indicated they never hunt in such conditions. These findings are consistent with earlier research from Germany, where Karger et al. (1996) reported that 22.1% of hunting accidents occurred during periods of reduced visibility.

Weapon Behaviour

Regarding the handling of weapons, the respondents in our study demonstrated a high level of responsibility. A total of 97.34% reported that they always store weapons and ammunition in a gun cabinet, while 88.17% stated they

always check the condition of the weapon before hunting. Comparable trends were found in Denmark, where 80% of the respondents reported secure storage (Therbo and Von der Osten 2008), and in Sweden, where 99% of hunters stored firearms and 96% stored ammunition in gun cabinets. In the same Swedish study, 96% of the respondents reported checking their weapons prior to hunting (Junuzovic et al. 2013). When asked about checking the condition of weapons before hunting, statistically significant differences were found between respondents depending on the hunting frequency ($p < 0.000$) and hunting experience ($p = 0.006$). These differences were attributable to more cautious behaviour among respondents who hunted less frequently (fewer than 10 times per year) and those with more than 10 years of hunting experience.

Additionally, 42.31% of the respondents reported knowing individuals who behaved carelessly with firearms during hunting. A statistically significant difference was observed between respondents who had gone hunting fewer than 10 times in the past year and those who had hunted more frequently ($p = 0.006$). This difference may be explained by the fact that more frequent hunters are exposed to a larger number of individuals, increasing the likelihood of encountering unsafe firearm behaviour. A similar pattern was reported in Sweden, where 35% of the respondents stated they had witnessed others handling firearms carelessly (Junuzovic et al. 2013). Furthermore,

Table 3. Weapon behaviour.

Question	Number (f)	Percentage (%)	Days hunting				Years hunting			
			<10	>10	χ^2	p	<10	>10	χ^2	p
I keep my weapons and ammunition in a gun cabinet:										
Always	329	97.34	49	280			61	268		
Often	9	2.66	1	8			3	6		
Sometimes	0	0.00	0	0	0.395	0.821	0	0	4.401	0.354
Rarely	0	0.00	0	0			0	0		
Never	0	0.00	0	0			0	0		
I check the condition of firearms before hunting:										
Always	298	88.17	46	252			57	241		
Often	26	7.69	3	23			2	24		
Sometimes	9	2.66	1	8	69.390	0.000	3	6	39.166	0.006
Rarely	4	1.18	0	4			2	2		
Never	1	0.30	0	1			0	1		
I know people who are careless with firearms when hunting:										
Yes	143	42.31	14	129			29	114		
No	85	25.15	23	62	23.151	0.006	16	69	12.190	0.580
I do not know/ I am not sure	110	32.54	13	97			19	91		
I know people who hunt, but because of all their physical and/or mental characteristics, they should not use firearms when hunting:										
Yes	107	31.66	11	96			26	81		
No	139	41.12	26	113	32.045	0.000	25	114	16.283	0.061
I do not know/ I am not sure	92	27.22	13	79			13	79		

31.66% of the respondents in our study reported knowing individuals who, due to physical or mental characteristics, should not be permitted to use firearms for hunting. This proportion is considerably higher than that recorded in Sweden, where only 16% of the respondents identified such individuals (Junuzovic et al. 2013). As with the previous question, a statistically significant difference ($p < 0.000$) was found between respondents who hunted fewer than 10 times in the last year and those who hunted more frequently.

Health Status

The majority of the respondents in Croatia reported being in good health, which suggests that health limitations are not a common barrier to participation in hunting. Specifically, 98.52% of the respondents reported no vision problems, 97.63% reported no hearing problems, and 94.38% reported no other health issues that could affect hunting activities. These figures contrast markedly with those reported in Sweden, where 44% of hunters stated they had vision problems, 30% reported hearing problems, and 17% reported cardiovascular conditions, most commonly hypertension (Junuzovic et al. 2013). One possible explanation for these discrepancies lies in the age difference between the two samples: the average age of respondents in our study was 46 years, compared to 54 years in the Swedish study.

Involvement in Firearm Accidents

In our study, 7.40% of the respondents ($n = 25$) reported witnessing a hunting accident in the past five years. Among them, two respondents admitted to causing the accident themselves, while 23 reported witnessing an accident caused by another hunter. These figures are somewhat higher than those reported in Denmark, where 71 out of 1797 respondents (3.95%) had been involved in or witnessed a hunting accident in the last 5 years; 32 had been involved and 39 had witnessed the accident (Therbo and Von der Osten 2009). Notably, the Swedish study reported significantly higher rates: 5% of the respondents

had personally caused an accident, and 23% had witnessed one caused by another hunter (Junuzovic et al. 2013).

In our study, the two respondents who had personally caused an accident were aged 39 and 40, while those who had witnessed an accident were, on average, 44.47 years old. Due to the small number of individuals who admitted causing an accident ($n = 2$), it is not possible to draw reliable conclusions about age-related risk. In the Swedish study, the average age of those who caused accidents was 52 years (Junuzovic et al. 2013), suggesting that older hunters may be at greater risk of involvement in an accident. Although it might be expected that hunters with more years of experience or a higher frequency of hunting would be at greater risk due to increased exposure, the literature presents mixed findings. Some studies indicate that younger hunters are more prone to accidents. For example, Cole and Patetta (1988) found that in North Carolina the average age of victims in hunting weapon accidents was 25, while the average age of shooters was 23. Similarly, in the study by Loder and Farren (2014), the average age of individuals involved in hunting accidents was 34.5 years. Hemenway et al. (2010) reported that 55% of those who caused fatal firearm accidents during hunting in the USA were under the age of 25. Earlier data from the USA and Canada from 1983 to 1986 revealed that 30% of fatalities and 27% of injuries occurred among individuals under 20 years of age (Carter 1989). Cole and Patetta (1988) explain the lower age of victims and shooters in the USA than in other countries by the fact that in most other countries minors are not allowed to hunt, in contrast to the USA, where people under the age of 18 are allowed to hunt. In addition to legal regulations, the participation of minors in hunting is influenced by socio-cultural factors and the cultural distance between the USA and Europe regarding firearms, firearm handling, and general attitudes toward hunting. Despite the legal requirement that a child under the age of 12 must be accompanied by an adult when using a gun, this is often ignored: of 29 accidents involving children under the age of 12, only 4 involved adults (Cherry et al. 2001).

Table 4. Health status.

Question	Number (f)	Percentage (%)	Days hunting				Years hunting			
			<10	>10	χ^2	p	<10	>10	χ^2	p
I have vision problems that can endanger me when hunting:										
Yes	2	0.59	1	1			1	1		
No	333	98.52	48	285	6.069	0.733	63	270	10.563	0.103
I do not know/ I am not sure	3	0.89	1	2			0	3		
I have hearing problems that could jeopardise my hunting:										
Yes	2	0.59	1	1			1	1		
No	330	97.63	47	283	4.639	0.865	62	268	14.777	0.097
I do not know/ I am not sure	6	1.78	2	4			1	5		
I have other health problems (such as high blood pressure or diabetes) that could jeopardise my hunting:										
Yes	9	2.66	2	7			1	8		
No	319	94.38	45	274	6.750	0.663	62	257	3.102	0.796
I do not know/ I am not sure	10	2.96	3	7			1	9		

Table 5. Involvement in firearm accidents.

Question	Number (f)	Percentage (%)
In the last 5 years I have experienced one or more accidents with firearms while hunting:		
Yes. I caused the accident.	2	0.59
Yes. Another hunter caused the accident.	23	6.80
No. I have not witnessed an accident involving firearms while hunting.	313	92.60
This firearm accident occurred:		
Before the hunt	0	0.00
During the hunt	23	92.00
After the hunt	2	8.00
The consequence of this firearm accident was:		
Death of another hunter	0	0.00
Wounding of another hunter	11	44.00
Self-injury	2	8.00
No consequences	11	44.00
Other	1	4.00
The cause of this firearm accident was:		
Malfunction of the firearm or ammunition	0	0.00
Careless handling of the firearm	10	40.00
Mistaking the victim for game	2	8.00
The victim was not within sight of the shooter	4	16.00
Fall or slip with loaded firearm	0	0.00
Firearm discharged	1	4.00
Other	8	32.00
Type of hunt during which this firearm accident occurred:		
Driven hunt for wild boar	11	44.00
Driven hunt for small game	10	40.00
Circular hunt	1	4.00
Other	3	12.00

On the other hand, several European and international studies suggest that older or more experienced hunters may also be at increased risk of involvement in accidents. This trend may reflect stricter firearm acquisition and usage laws outside the USA, which raise the minimum age of hunters and, consequently, the average age of those involved in accidents. For instance, in a Danish study, the average age of accident-involved hunters was 50.8 years (Therbo and Von der Osten 2009), while in a Turkish study it was 42.5 years (Özsoy et al. 2022), and in a Swedish study it was 46 years (Örnehult and Eriksson 1987). In addition to age, experience has also been highlighted as a factor. A study from Germany found that 92.1% of accidents involved hunters with more than five years of experience (Karger et al. 1996). The authors suggested that this could be due to overconfidence and reduced caution over time, as experienced hunters may not strictly adhere to safety practices or may have forgotten some of the rules learned during the hunting exam taken years earlier. Taken together, these findings suggest that both younger, less experienced hunters and

older, more experienced hunters may be at risk, though for different reasons: the former due to inexperience and risk-taking behaviour, and the latter due to overconfidence and weakening adherence to safety measures.

In our study, the majority of reported accidents ($n = 23$) occurred during the hunt, and only two after the hunt. This is in line with the findings from Sweden, where most accidents and fatalities occurred during hunting activities (Junuzovic et al. 2013). However, other studies report different trends. For example, Cherry et al. (2001) found that only 10% of firearm-related hunting fatalities occurred during the hunt, while most occurred before or after the hunt. Notably, 35% of those incidents were attributed to “playing” or “fooling around” with a firearm. Similarly, Lambrecht and Hargarten (1993) reported that most firearm injuries in Montana, both fatal and non-fatal, occurred after the hunt. In our data, 11 accidents resulted in injury to another hunter, 2 in self-inflicted injuries, while 11 incidents had no consequences. The predominant cause of accidents ($n = 10$) was careless handling of firearms. This finding is consistent with research

from Germany, where 37% of accidents were attributed to the same cause (Karger et al. 1996). In contrast, in North America during the 1980s, the most common cause was mistaken identity, i.e., confusing a hunter for game (Carter 1989). In our study, such cases were rare, occurring in only 8% of accidents. Importantly, none of the accidents in our sample were caused by defective weapons or ammunition. This aligns with findings by Carter (1989), where defective weapons accounted for only 2% of accidents, and by Karger et al. (1996), who reported an even lower rate of 1.6%. These data support the argument that human error is the leading cause of hunting accidents, rather than technical malfunctions (Karger et al. 1996).

Regarding the type of hunt, driven hunts appear particularly hazardous. In our study, 44% of accidents occurred during driven wild boar hunts and 40% during driven small game hunts. This pattern mirrors findings from Denmark, where 80% of accidents occurred during driven hunts (Therbo and Von der Osten 2009), and from Germany, where 35.5% of hunting accidents occurred in the same context (Karger et al. 1996). These results reinforce the idea that driven hunts, due to their dynamic and social nature, pose a significantly higher risk of firearm-related accidents.

Preventive Measures

The respondents in our study were also asked to evaluate the existing legal framework regulating the carrying and use of firearms during hunting. These include the Ordinance on the Use of Hunting Weapons and Ammunition (Official

Gazette 37/19), the Ordinance on Conditions and Methods of Hunting (Official Gazette 48/22), and the Hunting Act (Official Gazette 99/18, 32/19, 32/20, 127/24). The majority of respondents (66.27%) rated these legal provisions as optimal, suggesting a general sense of satisfaction with the current regulatory framework. However, attitudes regarding hunter training showed more nuance. Specifically, 65.68% of the respondents considered the current training provided before the hunting exam to be insufficient. A statistically significant difference was found based on years of hunting experience ($p = 0.025$), with more experienced hunters being critical of the adequacy of pre-exam education. This may suggest that experienced hunters, having encountered or witnessed hazardous situations, perceive existing training programs as inadequate or overly theoretical. Junuzovic and Eriksson (2012) argue that passing a hunting exam does not guarantee safe behaviour; in Sweden, 30% of hunters involved in fatal accidents had completed official training.

When the respondents were asked how accidents could best be prevented, the most common response (39.05%) was more careful handling of weapons, followed closely by better education and training (37.28%). This corresponds partly with the findings of a similar study conducted in Sweden, where 66% of hunters believed careful handling was the most effective preventive measure, while only 14% mentioned education or training (Junuzovic et al. 2013). Interestingly, a significantly larger proportion of Croatian hunters emphasised the importance of education and training, reflecting broader concerns already noted in this study.

Table 6. Preventive measures.

Question	Number (f)	Percentage (%)	Days hunting				Years hunting			
			<10	>10	χ^2	p	<10	>10	χ^2	p
The legal provisions in the Republic of Croatia that regulate the carrying of weapons when hunting are:										
Too strict	54	15.98	2	52			7	47		
Optimal	224	66.27	37	187	8.994	0.914	48	176	21.911	0.146
Too lenient	30	8.88	4	26			5	25		
I do not know/ I am not sure	30	8.88	7	23			4	26		
The training offered before the hunting test is sufficient to train hunters for safe hunting behaviour:										
Yes	77	22.78	17	60			18	59		
No	222	65.68	28	194	12.322	0.196	41	181	19.008	0.025
I do not know/ I am not sure	39	11.54	5	34			5	34		
Accidents with hunting weapons can best be prevented:										
By handling weapons more carefully when hunting	132	39.05	22	110			30	102		
By behaving more cautiously when hunting	40	11.83	8	32			11	29		
By avoiding alcohol consumption before, during and after the hunt	11	3.25	0	11	29.229	0.506	5	6	43.113	0.193
By not going hunting if you have health problems	0	0.00	0	0			0	0		
Through better education and training	126	37.28	15	111			15	111		
All of the above points	20	5.92	3	17			2	18		
Other	9	2.66	2	7			1	8		

CONCLUSIONS

This study offers insights into the behaviour, safety practices, and accident involvement of hunters in Croatia, shedding light on both national characteristics and broader international trends in hunting safety. Most respondents are experienced hunters, with many years of experience, and they mostly showed responsible attitudes towards firearm handling, particularly in terms of safe storage and pre-hunt weapon checks. Compared to similar studies from Sweden and Denmark, Croatian hunters appear to have slightly better compliance with some safety practices, such as the use of high-visibility clothing. However, the study also reveals significant areas for improvement. The limited use of hearing and eye protection among Croatian hunters mirrors a wider international trend, yet it remains a critical safety gap.

Regarding the secondary research aim, examining differences in attitudes between more and less experienced hunters, statistically significant differences were found in 6 out of 17 survey items. Hunters who engage in hunting more frequently (more than 10 times per year) reported consuming alcohol less often during hunts compared to those who hunt less frequently ($p = 0.006$). Additionally, respondents who hunt less frequently and those with more than 10 years of hunting experience demonstrated greater caution when checking their weapons ($p < 0.000$ and $p = 0.006$, respectively).

In terms of perceptions of other hunters, 42.31% of the respondents reported knowing individuals who handled firearms carelessly, while 31.66% stated they knew individuals who, due to physical or psychological reasons, should not be using weapons. Statistically significant differences were found for both statements between respondents who hunted more frequently and those who hunted less often ($p = 0.006$ and $p < 0.000$, respectively), likely indicating the greater exposure of more active hunters to a wider range of individuals.

Accidents were most frequently reported by experienced hunters, which may simply reflect greater

exposure. However, this observation also suggests a need for ongoing safety reinforcement among experienced hunters who might become complacent over time. Although younger hunters are often implicated in accidents in North American literature, European data, including the current study, suggest that older, experienced hunters are not immune to risk. This dual-risk profile highlights the need for safety initiatives to be tailored to all age groups, accounting for both inexperience and overconfidence.

Regarding prevention, the highest number of respondents believe that accidents can best be prevented through more careful weapon handling (39.05%) and better education and training (37.28%). Additionally, 65.68% of the respondents stated that the current training before the hunting exam is insufficient, with a statistically significant difference observed depending on years of hunting experience ($p = 0.025$). More experienced hunters, in particular, questioned the adequacy of the pre-test education in preparing hunters for real-world scenarios.

In conclusion, hunting safety depends on a combination of individual responsibility, hunting frequency, the quality of training, and the effectiveness of legal regulations. Continuous improvement of training and regular reinforcement of safety measures, targeted not only at beginners but also at experienced hunters, is necessary.

Author Contributions

HM and KT conceived and designed the research, HM and KT carried out the data collection, HM processed the data and performed the analysis, HM and KT wrote the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

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