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Trends of fatal unintentional injuries among working-age adults in Finland between 1998 and 2022

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ABSTRACT

Background: Unintentional injuries pose significant challenges to public health, impacting individuals and communities. They also create significant economic costs for society as a whole. Common preventable fatal unintentional injuries among adults of working age include, among others, falls, poisonings, traffic accidents and drowning.
Aim: To examine the incidence trends of the changes in fatal unintentional injuries among working-age (25–64) adults in Finland, with alcohol and/or drug intoxication as a contributing cause of death.
Methods: We used open data from the Causes of Death register hosted by Statistics Finland. Injury deaths between 1998 and 2022 were included in the analysis. The Mann-Kendall non-parametric trend test was used for incidence rates, assessing whether a monotonic trend was present.
Results: The most common fatal unintentional injuries in working-age adults in Finland were due to poisonings, falls and traffic accidents. The results showed a significant downward trend in the number of all fatal unintentional injuries, with the exception of poisonings among the youngest age group, 25–34 years, in both males and females. The incidence of fatal unintentional injuries among men decreased by 53 % during the study period, and by 46 % among women. Men were more frequently involved in fatal unintentional injuries than women.
Conclusion: Fatal unintentional injuries among the working-age population have decreased in Finland due to national collaborative efforts in recent decades. However, preventive measures are still needed, especially to prevent unintentional injuries caused by substance abuse.

Introduction

Unintentional injuries are a major public health issue with individual, social, societal and economic consequences [1]. In 2019, unintentional injuries claimed the lives of 3.26 million people around the world [2]. There were 153,500 deaths in the EU resulting from accidents in 2020 [3]. Incidence and mortality rates caused by injury vary within European regions, where rates were highest in Eastern Europe and lowest in Western Europe [4]. Some of these variations may be explained by differences in the compilation of statistics and reporting; however, country-specific trends do not have these limitations. Finland, a northern European, high-income country with a population of 5.6 million, had a total of nearly 2,300 deaths due to unintentional injuries in 2022 [5].

Many studies on fatal unintentional injuries focus on children and youth [6–8] or the elderly [9,10], while unintentional injury deaths among working-age adults have been explored relatively little [11]. A study conducted in 2021 showed that the frequency of fatal accidents per 100,000 employed individuals varied. It was below 1.00 in the Netherlands, Greece, Finland, Sweden and Germany, while exceeding 3.00 in Romania, France, Malta, Lithuania and Latvia. The main areas of deaths were construction, transportation and storage, manufacturing and agriculture. [12]

Unintentional injuries are the fourth most common cause of death in Finland and almost 90 % of these deaths happen at home or during leisure time [13]. Apart from causing mortality, unintentional injuries

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cause morbidity that overburdens health services. In Finland, in 2022, 49,000 people were treated as inpatients in hospital wards and 271,000 people made 455,000 outpatient visits due to an unintentional injury. Of the inpatients, 14,000 were of working age. [14] Higher rates of injury risks have been observed among young adults aged 17–29 years. This increased risk is influenced by both the social background of their parents and the young adults' own social characteristics, which contribute to significant social disparities in hospital-treated injuries and poisonings during late adolescence. [15] Previous studies showed that Finland experienced a major change in the profile of fatal unintentional injuries among persons aged 15 years or older between 1971 and 2016 [6,16,17]. During that period, falls and poisonings replaced road traffic accidents as the leading causes of deaths from unintentional injury. Another study found a significant decrease in the number of fatal alcohol poisonings in Finland between 1987 and 2018 [18]. At the same time, the trend in fatal drug poisonings has increased [19,20]. These results reflected the drastic improvement in road traffic safety, the ongoing ageing of the population and the changes in the consumption of alcohol and other substances in Finland. A Swedish study found similar results, where mortality among working-age adults (18–64 years) decreased for traffic collisions and drownings and increased for poisonings between 1999 and 2012 [11].

As noted above, typical fatal unintentional injuries among working-age adults are due to falls, poisonings, traffic accidents and drownings, but the range of different fatal injuries varies between societies, age groups and genders [14]. In 2019, falls accounted for over 684,000 deaths globally [2]. The risk of fatal falls among working-age adults increases with age [21]. A study on fatal poisonings in Northern Finland found that their causes differ significantly between urban and rural areas, while the overall incidence does not. Urban areas had a higher rate of fatal poisonings related to psychoactive pharmaceutical products and opioids, while rural areas had a higher rate of fatal ethanol poisonings. [22] Even low alcohol intake can be associated with an increased risk of hospital contacts due to alcohol and unintentional injuries [23]. The role of intoxication is highlighted in unintentional injuries among working-age adults [24].

Since injury mortality may differ between age groups, it is important to examine age-specific mortality trends. Unintentional injury mortality among working-age adults in Finland is still understudied. Following our previous study on fatal unintentional injuries among older adults (65+), the purpose of this study was to examine the incidence of fatal unintentional injuries among working-age adults (aged 25–64 years) in Finland between 1998 and 2022. The definition of working age in this study is according to the Finnish programme for the prevention of home and leisure injuries "Safety at All Ages in 2021–2030", launched by The Ministry of Social Affairs and Health [13]. The aim of this study was to examine the incidence trends of the changes in fatal unintentional injuries among working-age adults in Finland. In addition, the prevalence of alcohol and drug intoxication as a contributing cause in fatal unintentional injury deaths was assessed. The purpose was to provide a comprehensive overview of Finnish injury deaths among working-age adults over the last 25 years.

Materials and methods

Open data from the Causes of Death register hosted by Statistics Finland [5] was used as study data. Injury deaths between 1998 and 2022 were included in the analysis. The data contains all injury deaths in Finland and exhibits the cause of injury codes according to the ICD-10 classification system [25] throughout the study period. The mechanism of injury was divided into nine categories based on ICD-10 codes: falls (W00–W19), poisoning (X40–X49), drowning (W65–W74, V90, V92), man-made heat (e.g., sauna) (W92), asphyxiation (W74–W84), fire-related (X00–X09), cold (X31), exposure to inanimate mechanical forces (W20–W49) and traffic (V01–V99, excl. V90, V92) [25]. Demographic factors available in the data were gender and age group (5-year). On the death certificate, alcohol and/or drug intoxication (T510–T519, T523, T528, T360–T509) is recorded as a contributing cause of death, where applicable.

In assessing whether a monotonic trend was present, the Mann-Kendall non-parametric trend test was used for incidence rates. Mann-Kendall trend test is a non-parametric alternative to conventional regression modeling and makes no assumptions of distribution of underlying data but is based on ranks in observations [26]. Additionally, the trend is not constrained to be linear(ish). The analysis was explorative, and the interest was whether a (monotonic) trend was present, but not detailed value of regression parameters while provided endpoint estimates reveal the total magnitude of change in the study period. Additionally, incidence rates at the beginning and end of the study period were compared in order to observe the potential magnitude of change. These comparisons were performed with 3-year averages (1998–2000 vs 2020–2022) to mitigate statistical variation to some extent and were reported as Incidence Rate Ratios with 95 % confidence intervals. In general, assessments were first divided into four age groups: 25–34, 35–44, 45–54 and 55–64 years. To reduce variation in the statistics and to facilitate the interpretation of the results, the four age groups were then combined into two larger age groups: 25–44 (younger working-age adults) and 45–64 years (older working-age adults). These groups describe the life span of working-age people. The R software version 4.1.1. [27] was used to conduct analyses.

Ethical considerations

This study is based on open data from the Causes of Death register hosted by Statistics Finland and ethical approval was not required.

Results

A total of 22,775 deaths by unintentional injury were observed during the study periods. During the period 1998–2000, 3,298 men died as a result of injury, and in the period 2020–2022 the number was 1,552, a decrease of 53 %. The corresponding number for women between 1998–2000 was 739 and between 2020–2022 it was 398, a decrease of 46 %. Males accounted for 80 % of the deaths. The main types of injuries resulting in death in males in order of prevalence between 1998–2000 was due to poisonings, falls and traffic accidents; between 2020–2022 these were poisonings, traffic accidents and falls. In females, the main types of fatal injuries were due to poisonings, traffic accidents and falls between 1998–2000, and poisonings, falls and traffic accidents between 2020–2022. (Table 1).

Intoxication is a major factor behind fatal unintentional injuries among working-age adults in Finland, but the percentage of intoxicated persons varies between the different injury types. Overall, there has not

Table 1
Distributions of injury mechanisms by gender at two time points (1998–2000 vs. 2020–2022).

	Male, %		Female, %	
	1998–2000	2020–2022	1998–2000	2020–2022
Poisonings (X40–X49)	33.9	46.2	40.2	49.1
Falls (W00–W19)	20.2	15.3	16.7	18.2
Traffic (V01–V99, excl. V90, V92)	17.1	15.6	22.5	12.7
Drownings (W65–W74, V90, V92)	12.1	8.3	6.4	5.0
Asphyxiations (W75–W84)	4.3	4.0	6.6	6.1
Fire-related (X00–X09)	4.1	2.1	2.9	2.6
Cold (X31)	3.4	3.6	2.5	3.2
Inanimate mechanical forces (W20–W49)	2.7	3.2	0.4	1.1
Sauna (W92)	2.1	1.7	1.8	2.1
Total	100.0	100.0	100.0	100.0

been a dramatic change in the percentage of intoxication in deaths by injury between the years 1998–2000 and 2020–2022 (Table 2). The correlation between the annual number of deaths due to alcohol poisoning and national alcohol consumption is of the order of 0.82 in the period 1998–2021 [28].

Injuries among males

We compared two time points, the years 1998–2000 and 2020–2022 using 3-year averages. Between 1998–2000, 34 % of fatal injuries were due to poisonings, 20 % due to falls and 17 % due to traffic accidents in males. Between 2020–2022, poisonings accounted for 43 %, traffic accidents 15 % and falls 14 % of fatal injuries among males (Table 1). The highest number of fatal injuries occurred among those aged between 45 and 64 years. However, overall, there has been a decrease in incidence rates of deaths by injury among Finnish working-age males. The incidence rate ratio for the different injury types ranged from 0.13 to 0.82 for males aged 25–44 years and from 0.29 to 0.71 for males aged 45–64 years (Table 3).

Poisonings were the most common type of fatal injury among working-age males. The incidence rate ratio (2020–2022 to 1998–2000) for poisonings was 0.82 for males aged 25–44 years and 0.49 for males aged 45–64 years (Table 3). There was a downward trend in the number of poisonings among males in all age groups, except for the youngest age group, 25–34 years (Table 4).

During the study period, traffic accidents replaced falls as the second most common type of fatal injury among working-age males. The incidence rate ratio for traffic accidents was 0.42 for males aged 25–44 years and 0.39 for males aged 45–64 years (Table 3). There was a statistically significant downward trend in traffic accidents among males in all age groups (Table 4).

Falls were also a common cause of fatal injury among working-age males. The incidence rate ratio for falls was 0.18 for males aged 25–44 years and 0.38 for males aged 45–64 years (Table 3). There was a statistically significant downward trend in falls among males in all age groups (Table 4).

Intoxication was quite common among working-age males who died due to unintentional injuries. In 2020–2022, 43.2 % of males who died due to traffic accidents were intoxicated. Correspondingly, among males who died due to falls, the figure was 34.2 % (Table 2).

Injuries among females

Between 1998–2000, 40 % of fatal injuries were due to poisonings, 22 % due to traffic accidents and 17 % due to falls in females. Between 2020–2022, poisonings accounted for 47 %, falls 17 % and traffic accidents 12 % of fatal injuries among females. The age group with the most fatal injuries was 45–64 years. (Table 1). There was a decrease in the incidence rates of deaths by injury among Finnish working-age females. The incidence rate ratio for the different injury types ranged from 0.11 to 0.72 for females aged 25–44 years and from 0.30 to 0.82 for females aged 45–64 years (Table 3).

Poisonings were one of the most common types of fatal injuries among working-age females as well. The incidence rate ratio (2020–2022 to 1998–2000) for poisonings was 0.72 for females aged 25–44 years and 0.59 for females aged 45–64 years (Table 3). Although the proportion of poisonings in injury deaths increased, there was a downward trend in the number of poisonings among females in all age groups except for the youngest group, 25–35 years (Table 4).

The incidence rate ratio in traffic accidents was 0.29 for females aged 25–44 years and 0.30 for females aged 45–64 years (Table 3). There was a statistically significant downward trend in traffic accidents among females in all age groups (Table 4). The incidence rate ratio for falls was 0.54 for females aged 25–44 years and 0.57 for females aged 45–64 years (Table 3). There was a downward trend in falls among females in all age groups (Table 4).

Intoxication was less common in females than males who died due to traffic accidents: 18.8 % of females in this study were intoxicated between 2020–2022. Of the females who died due to falls, 34.8 % were intoxicated (Table 2).

Discussion

Studies have shown that there is a general downward trend in terms of unintentional deaths in Europe [11,29]. This indicates that the preventive actions that have been implemented to reduce injuries have been effective, although injury prevention policies may differ between countries. On the other hand, countries with similar socio-economic and technological contexts may have entirely different injury profiles [21]. Our study showed a downward trend in the number of all fatal unintentional injuries, but the trend for poisonings was not as drastic as it was for other types of injuries.

This national study provides an overview of fatal unintentional injuries among working-age adults in Finland between 1998 and 2022. Our study revealed that men were more frequently involved in fatal unintentional injuries than women. The findings are in accordance with previous studies [11,30–32]. Our study showed that the three most common fatal injuries among both males and females in Finland were due to poisoning, falls and traffic accidents. This study aligns with a study from Georgia in 2018, which showed that traffic accidents and falls were the primary causes of injury mortality. Their study showed that of all fatal injuries, 74 % were unintentional injuries. High rates of inanimate mechanical forces cause death in the working age. [26] Another study conducted in Europe in 2004 showed that road traffic injuries accounted for the highest proportion of unintentional injury deaths, followed by falls and drowning [31].

Intoxication is a well-known risk factor for various kinds of accidents. In our study, the proportion of intoxication decreased for most of the injury types between the studied time periods (1998–2000 and 2020–2022). This trend coincided with a historical drop in the total alcohol consumption in Finland [33] which likely explains at least in part the decreasing intoxication proportions in injury deaths. However, there was an increase in the proportion of intoxication among fatal traffic-related injuries. At the same time, the total number of fatal traffic

Table 2
Proportions of those marked as intoxicated by each injury mechanism between the first period 1998–2000 and the second period 2020–2022.

	Year, male, %		p-value	Year, female, %		p-value
	1998–2000	2020–2022		1998–2000	2020–2022	
Falls	43.7	34.2	0.017	36.9	34.8	0.894
Traffic	36.4	43.2	0.090	14.6	18.8	0.642
Drowning	68.6	61.2	0.157	61.7	36.8	0.118
Asphyxiation	62.8	63.8	1.000	41.7	60.9	0.207
Fire-related	71.8	77.4	0.680	76.2	70.0	1.000
Cold	70.9	58.5	0.161	72.2	58.3	0.693
Sauna	89.7	88.0	1.000	92.3	87.5	1.000
Inanimate mechanical forces	13.6	13.0	1.000	100.0	25.0	0.225*

* Too few data points for meaningful comparison

Table 3
Incidence rate ratios by each injury mechanism at two time points by age group and gender.

Incidence Rate Ratio 2020–2022 to 1998–2000 (95 % Confidence Interval, n)				
	Male 25–44	Male 45–64	Female 25–44	Female 45–64
Poisoning	0.82 (0.71–0.94) (410,338)	0.49 (0.43–0.55) (676,334)	0.72 (0.53–0.97) (102,72)	0.59 (0.47–0.75) (191,114)
Falls	0.18 (0.11–0.27) (139,25)	0.38 (0.32–0.45) (509,197)	0.54 (0.23–1.20) (17,9)	0.57 (0.41–0.78) (105,60)
Traffic	0.42 (0.34–0.53) (253,108)	0.39 (0.32–0.49) (297,119)	0.29 (0.18–0.45) (81,23)	0.30 (0.19–0.46) (83,25)
Drowning	0.29 (0.20–0.42) (116,34)	0.31 (0.25–0.40) (273,87)	0.64 (0.19–1.96) (8,5)	0.36 (0.19–0.65) (39,14)
Asphyxiation	0.23 (0.09–0.51) (30,7)	0.47 (0.33–0.65) (107,51)	0.39 (0.08–1.39) (8,3)	0.50 (0.29–0.85) (40,20)
Fire-related	0.13 (0.05–0.29) (46,6)	0.29 (0.18–0.45) (85,25)	0.11 (0.005–0.61) (10,1)	0.82 (0.33–2.00) (11,9)
Cold	0.65 (0.34–1.19) (26,17)	0.42 (0.28–0.62) (84,36)	0.45 (0.09–1.66) (7,3)	0.82 (0.33–2.00) (11,9)
Inanimate mechanical forces	0.26 (0.12–0.51) (38,10)	0.71 (0.46–1.09) (50,36)	N/A (0,2)	0.68 (0.08–4.47) (3,2)
Sauna	0.31 (0.09–0.89) (13,4)	0.38 (0.22–0.61) (55,21)	N/A (1,0)	0.67 (0.26–1.63) (12,8)
All causes*	0.51 (0.46–0.56) (1094,563)	0.44 (0.41–0.48) (2204,989)	0.53 (0.43–0.66) (237,124)	0.54 (0.47–0.63) (502,274)
Incidence rate=count/person years				

* All causes = V01–X59, Y85–Y86
N/A = not applicable

Table 4
Direction of trends by each injury mechanism, age group and gender.

Direction of trend (p-value)	Male 25–34	Male 35–44	Male 45–54	Male 55–64	Female 25–34	Female 35–44	Female 45–54	Female 55–64
Poisoning	↗	↘ *	↘ *	↘ *	↗	↘ *	↘ *	↘ *
Falls	↘ **	↘ **	↘ **	↘ **	↘	↘ *	↘ **	↘ **
Traffic	↘ **	↘ **	↘ **	↘ **	↘ **	↘ **	↘ **	↘ **
Drowning	↘ **	↘ **	↘ **	↘ **	↘	↘ *	↘ *	↘ *
Asphyxiation	↘	↘ *	↘ **	↘ *	↘	↘	↘ *	↘
Fire-related	↘ *	↘ **	↘ **	↘ **	↘ **	↘	↘	↗
Cold	↘	↘ *	↘ *	↘ *	↘	↘	↘	↗
Sauna	↘	↘	↘ **	↘ *	↘	↗	↘	↘
Inanimate mechanical forces	↘ **	↘ **	↘ *	↘ *	↘	↗	↗	↘

** $p<0.001$,
* $p<0.05$, no asterisk = $p \geq 0.05$

accidents decreased by more than half from 396 fatalities in 2000 to 196 in 2022. This disproportion indicates that as the absolute numbers of fatal traffic accidents have gone down, the decrease has in fact mostly taken place among individuals that were not intoxicated. Worldwide, alcohol intoxication is estimated to be involved in 5–35 % of all fatal road traffic accidents [34]. In our study in 2020–2022, the proportion of intoxication in fatal traffic injury deaths was 43.2 % among males and 18.8 % among females. Although these figures align which those reported from other countries, the increase in the proportion of intoxication is alarming and indicates that driving under the influence presents a continued challenge for road safety and injury prevention programs in Finland.

Earlier research has shown that over time and across different cultures men have shown greater involvement than women in alcohol related risks, such as driving under the influence of alcohol [35] and to some degree also in driving under the influence of drugs [36]. Likewise in our study, in both studied time points, the proportion of females that were intoxicated while facing a fatal traffic injury was markedly lower than that of males. Apart from traffic injuries, only minor differences were found between males and females in terms of intoxication.

Poisoning was by far the most common fatal injury among working-aged adults in this study. Whilst nearly all injury mechanisms saw a decreasing trend, there was an upward trend in poisoning mortality in the youngest age group both in males and females. This finding is not unexpected, as Finland has in recent years been among the European countries with the highest proportion of young individuals dying of drug-related death [37]. Although European countries have so far avoided the massive overdose death crisis that has been witnessed in North America, the temporal increase in poisoning mortality seen in this study is a matter of concern in Finland. Unintentional poisoning deaths are largely attributed to drug abuse and less to administration of wrong drug or inadvertent consumption [38] and thus the prevention methods should be addressed accordingly.

Finland has a long tradition of national programmes for preventing unintentional injuries. These programmes have been inviting different stakeholders from national, regional and local level, from the public sector and NGOs, to work together in creating measures to decrease both fatal and non-fatal unintentional injuries. The work is carried out vigorously and persistently in organizations that engage directly with citizens' everyday lives.

The latest national programme was drawn up in 2021 under the coordination group for the prevention of home and leisure injuries appointed by the Ministry of Social Affairs and Health. The Finnish programme for the prevention of home and leisure injuries, "Safety at All Ages", contains a total of 89 measures aimed at preventing injuries during different stages of life. Of these measures, 37 are aimed at preventing injuries among working-age adults aged 25–64 years. Thirteen measures address the role of alcohol and other substance use in preventing unintentional injuries. [13] Broad sectoral expert groups meet twice a year to share information on the progress of the actions. The implementation of the programme is coordinated by the Finnish Institute for Health and Welfare (THL in the Finnish acronym).

Simultaneously, another national strategy was developed: the Substance Use and Addiction Strategy, with joint guidelines until 2030, aims to provide more comprehensive guidance on the prevention and treatment of risks, harms and problems related to alcohol, tobacco, drugs and gambling [39]. For example, there is a widely adopted evidence-based model for preventive substance abuse work, including community interventions, known as the Pakka -model. It aims to influence the responsibility of business operators, particularly in retail and licensed establishments, as well as sales control, collaboration with authorities, and social regulation. [40] These strategies complement and reinforce the actions of each other. In Finland, various strategies have been developed in collaboration with different stakeholders, such as

government sectors, national and regional actors and organisations, resulting in synergy benefits.

Strengths and limitations

There are some limitations to this study. Due to the nature of the data, only the structures defined by the ICD-10 classification system could be analysed, and therefore certain potentially interesting details, such as the settings of accidents, socio-economic factors or the victims' functional ability, could not be reported. This means that the study is rather general or non-specific. Furthermore, the data presents results from only one country, which can limit the generalisability of the results. In this study, the small sample sizes, especially for deaths of young women, might increase the risk of biased results.

This study's strength lies in its use of representative, population-wide data, encompassing all fatal injuries across the entire country and employing the ICD-10 classification system consistently throughout its duration, thus ensuring exceptional coherence in trend analysis. Additionally, unintentional injury deaths among working-age adults have been explored relatively little. In Finland, the proportion of forensic investigation of causes of death is exceptionally large compared to the European scale. The rate of medico-legal autopsies among unintentional injury deaths was 87.2 % in 2000–2003 [41], with likely no marked changes over recent years. The high rate of autopsies allowed for reliable statistics concerning injury-related deaths.

Conclusion

The results provide more knowledge on fatal unintentional injuries among the working-age population in Finland, which has been sparsely studied. It showed a 25-year downward trend for most injuries. Poisonings were one of the most common types of fatal injuries among both men and women. Although the trend was in general downward in almost all age groups, it should be noted that this does not apply to the youngest age group, 25–34 years. Continuous preventive measures and educational initiatives are crucial to improve safety and prevent unintentional injuries.

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Data availability

Data are publicly available from Statistics Finland. It can be obtained through the Statistics Finland website: https://pxdata.stat.fi/PXWeb/pxweb/en/StatFin/StatFin_ksyyt/?tablelist=true.

Ethical considerations

This study is based on open data from the Causes of Death register hosted by Statistics Finland and ethical approval was not required.

CRediT authorship contribution statement

Hanna Kettunen: Writing – original draft, Visualization, Conceptualization. **Tuija Ylitörmänen:** Writing – original draft, Visualization, Conceptualization. **Ulla Korpilahti:** Writing – review & editing, Conceptualization. **Pirkko Kriikku:** Writing – review & editing, Conceptualization. **Antti Impinen:** Writing – review & editing, Conceptualization. **Riitta Koivula:** Writing – review & editing, Conceptualization. **Kari Haikonen:** Writing – review & editing, Visualization, Methodology, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare no conflicts of interest.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.injury.2024.112030.

References

[1] Newnam S, Collie A, Vogel AP, Keleher H. The impacts of injury at the individual, community and societal levels: a systematic meta-review. Public Health 2014;128(7):587–618. https://doi.org/10.1016/j.puhe.2014.04.004.
[2] WHO. Preventing injuries and violence: an overview. World Health Organization; 2022. Available from: https://iris.who.int/bitstream/handle/10665/361331/9789240047136-eng.pdf?sequence=1. accessed 5 August 2024.
[3] Official Statistics Finland (OSF): Accidents and injuries statistics - statistics explained, 2024. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Accidents_and_injuries_statistics#Deaths_from_accidents.2C_injuries_and_assault. (accessed 5 August 2024).
[4] Haagsma JA, Charalampous P, Ariani F, Gallay A, Moesgaard Iburg K, Nena E, et al. The burden of injury in central, eastern, and western European sub-region: a systematic analysis from the global burden of disease 2019 study. Arch Public Health 2022;80:142. https://doi.org/10.1186/s13690-022-00891-6.
[5] [dataset]Official Statistics Finland (OSF): Causes of death - statistics Finland, 2024. Available from: https://stat.fi/en/statistics/ksyyt. (accessed 5 August 2024).
[6] Parkkari J, Mattila VM, Niemi S, Kannus P. Fatal childhood injuries in Finland between 1971 and 2017. Inj Epidemiol 2020;7:11. https://doi.org/10.1186/s40621-020-00238-1.
[7] Gallagher L, Breslin G, Leavey G, Curran E, Rosato M. Determinants of unintentional injuries in preschool age children in high-income countries: A systematic review. Child 2024;50:e13161. https://doi.org/10.1111/cch.13161.
[8] Peden AE, Cullen P, Francis KL, Moeller H, Peden MM, Ye P, et al. Adolescent transport and unintentional injuries: a systematic analysis using the global burden of disease study 2019. Lancet Public Health 2022;7(8):e657–69. https://doi.org/10.1016/S2468-2667(22)00134-7.
[9] Ylitörmänen T, Nuotio MS, Kettunen H, Impinen A, Koivula R, Haikonen K. Trends of fall-related and other fatal injuries in older adults in Finland between 1998 and 2020. Euro J Public Health 2023;33(6):1065–70. https://doi.org/10.1093/eurpub/ckad177.
[10] Haagsma JA, Olij BF, Majdan M, van Beeck E, Vos T, Castle C, et al. Falls in older aged adults in 22 European countries: incidence, mortality and burden of disease from 1990 to 2017. Inj Prev 2020;26(Suppl 2):i67–74. https://doi.org/10.1136/injuryprev-2019-043347.
[11] Bäckström D, Larsen R, Steinvall I, Fredrikson M, Gedeborg R, Sjöberg F. Deaths caused by injury among people of working age (18–64) are decreasing, while those among older people (64+) are increasing. Eur J Trauma Emerg Surg 2018;44(4):589–96. https://doi.org/10.1007/s00068-017-0827-1.
[12] Eurostat Statistics Explained. Accidents at work statistics - statistics explained, 2024. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Accidents_at_work_statistics. (accessed 5 August 2024).
[13] Korpilahti U, Koivula R, Doupi P, Jakoaho V, Lillsunde P. Safely at all ages – programme for the prevention of home and leisure injuries 2021–2030. Available from: http://urn.fi/URN:ISBN:978-952-00-5398-7. (accessed 5 August 2024).
[14] Finnish Institute for Health and Welfare (THL) [In Finnish]. Statistical Report 57/2023. Available from: https://www.julkari.fi/bitstream/handle/10024/147451/tapaturmat%20tr%2057_2023.pdf?sequence=1&isAllowed=y. (accessed 5 August 2024).
[15] Remes H, Martikainen P. Young adults' own and parental social characteristics predict injury morbidity: a register-based follow-up of 135,000 men and women. BMC Public Health 2015;15:429. https://doi.org/10.1186/s12889-015-1763-9.
[16] Kannus P, Niemi S, Palvanen M, Parkkari J, Järvinen M. Secular trends in rates of unintentional injury deaths among adult Finns. Injury 2005;36(11):1273–6. https://doi.org/10.1016/j.injury.2005.07.011.
[17] Kannus P, Niemi S, Parkkari J, Sievänen H. Unintentional injury deaths in adult Finnish population: nationwide statistics between 1971 and 2016. Int J Inj Contr Saf Promot 2019;26(4):360–3. https://doi.org/10.1080/17457300.2019.1616768.
[18] Kriikku P, Ojanperä I. Significant decrease in the rate of fatal alcohol poisonings in Finland validated by blood alcohol concentration statistics. Drug Alcohol Depend 2020;206:107722. https://doi.org/10.1016/j.drugalcdep.2019.107722.
[19] Simonsen KW, Kriikku P, Thelander G, Edvardsen HME, Thordardottir S, Andersen CU, et al. Fatal poisoning in drug addicts in the Nordic countries in 2017. Forensic Sci Int 2020;313:110343. https://doi.org/10.1016/j.forsciint.2020.110343.
[20] Levola J. Premature mortality due to alcohol and substance use disorders in Finland - a review. Psychiatria Fennica 2022;53:230–9. https://www.psykiatriantutkimussaatio.fi/wp-content/uploads/2022/11/Psychiatria_Fennica-2022-Levola.pdf.
[21] Kool B, Ameratunga S, Robinson E, Jackson R. Hospitalisations and deaths due to unintentional falls at home among working-aged New Zealanders. Injury 2007;38:570–5. https://doi.org/10.1016/j.injury.2006.10.014.

[22] Koskela L, Raatiniemi L, Bakke HK, Ala-Kokko T, Liisanantti J. Fatal poisonings in Northern Finland: causes, incidence, and rural-urban differences. Scand J Trauma Resusc Emerg Med 2017;25:90. https://doi.org/10.1186/s13049-017-0431-8.
[23] Kruckow S, Santini ZI, Hjarnaa L, Becker U, Andersen O, Tolstrup JS. Associations between alcohol intake and hospital contacts due to alcohol and unintentional injuries in 71,025 Danish adolescents – a prospective cohort study. EClinicalMedicine 2023;64:102187. https://doi.org/10.1016/j.eclinm.2023.102187.
[24] Chikritzhs T, Livingston M. Alcohol and the Risk of Injury. Nutrients 2021;13:2777. https://doi.org/10.3390/nu13082777.
[25] ICD-10 Version, 2019. Available from: https://icd.who.int/browse10/2019/en#/W00. (accessed 5 August 2024).
[26] Kendall MG. Rank correlation methods. 4th ed. London: Griffin, C.; 1975.
[27] R: The R project for statistical computing, 2023. Available from: https://www.r-project.org/. (accessed 5 August 2024).
[28] Metadata - Sotkanet.fi, Statistics and Indicator Bank. Available from: https://sotkanet.fi/sotkanet/en/metadata/indicators/3629. (accessed 5 August 2024).
[29] Sengoelge M, Leithaus M, Braubach M, Laflamme L. Are there changes in inequalities in injuries? A review of evidence in the WHO European Region. Int J Environ Res Public Health 2019;16(4):653. https://doi.org/10.3390/ijerph16040653.
[30] Aldridge E, Sethi D, Yon Y. Injuries: a call for public health action in europe: an update using the 2015 who global health estimates. World health organization. regional office for Europe; 2015. Available from: https://iris.who.int/handle/10665/344128.
[31] Chandran A, Hyder AA, Peek-Asa C. The global burden of unintentional injuries and an agenda for progress. Epidemiol Rev 2010;32(1):110–20. https://doi.org/10.1093/epirev/mxq009.
[32] Chkhaberidze N, Axobadze K, Kereselidze M, Pitskhelauri N, Jorbenadze M, Chikhladze N. Study of epidemiological characteristics of fatal injuries using death registry data in Georgia. Bull Emerg Trauma 2023;11(2):75–82. https://doi.org/10.30476/beat.2023.97931.1418.
[33] Tigerstedt C, Makela P, Karlsson T, Härkönen J, Lintonen T, Warpenius K. Change and continuity in Finnish drinking in the 21st century. Nordic Stud Alcohol Drugs 2020;37(6):609–18.
[34] Global status report on road safety 2018. Available from: https://www.who.int/publications/i/item/9789241565684. (accessed 31 October 2024).
[35] Chan KK, Neighbors C, Gilson M, Larimer ME, Alan Marlatt G. Epidemiological trends in drinking by age and gender: Providing normative feedback to adults. Addict Behav 2007;32(5):967–76.
[36] Pelletti G, Boscolo-Berto R, Barone R, Giorgetti A, Fiorentini C, Pascali JP, et al. Gender differences in driving under the influence of psychoactive drugs: Evidence mapping of real case studies and meta-analysis. Forensic Sci Int 2022;341:111479.
[37] European Drug Report 2024: Trends and Developments. Available from: https://www.euda.europa.eu/publications/european-drug-report/2024_en. (accessed 31 October 2024).
[38] Chrzanowska A, Man N, Darke S, Degenhardt L, Farrell M, Moran L, et al. Unintentional and intentional drug poisoning deaths, Australia, 2012–2016: Drug pattern profile and demographic characteristics. Drug Alcohol Depend 2021;229:109112.
[39] Kotovirta E, Markkula J, Pajula M. Substance use and addiction strategy. Joint guidelines until 2030. [In Finnish] Available from: https://julkaisut.valtioneuvosto.fi/handle/10024/163002.
[40] Markkula J, Rapeli S, Kemppainen J, Kotovirta E. Action plan on alcohol, tobacco, drugs and gambling - Interim review and measures to be enhanced by 2025. Finland: Ministry of Social Affairs and Health; 2021 [In Finnish]Available from: http://urn.fi/URN:ISBN:978-952-00-9887-2. accessed 31 October 2024.
[41] Lunetta P, Lounamaa A, Sihvonen S. Surveillance of injury-related deaths: medicolegal autopsy rates and trends in Finland. Inj Prev 2007;13(4):282–4. https://doi.org/10.1136/ip.2006.012922.