Ann Ig. 2024 May-Jun; 36(3): 302-312. doi: 10.7416/ai.2024.2620.

Injury Patterns and Gender in Italy

Elisa Maietti[1], Angelo Capodici[1], Francesco Sanmarchi[1], Maria Pia Fantini[1], Nicola Nante[2], Davide Golinelli[1,2]

Keywords: Road Traffic Accidents; Home-Leisure Accidents; Gender Differences; Age Differences; EHIS Data; Injury Risk

Parole chiave: Incidenti Stradali; Incidenti Domestici e nel Tempo Libero; Differenze di Genere; Differenze di Età; Dati EHIS; Rischio di incidenti

Abstract

Introduction. *Globally, injuries pose significant public health challenges, with road traffic accidents in particular being responsible for considerable morbidity, mortality, and economic distress. Italy has been significantly impacted due to its high population density and frequency of road traffic and domestic incidents.*

Method. *This study set out to investigate the incidence of self-reported road traffic and home and leisure accidents in the Italian general population. A particular emphasis was placed on exploring possible gender differences across varying age groups. The data was obtained from the European Health Interview Survey and a representative sample of the Italian population was analyzed.*

Results. *The analysis revealed that regardless of age, women experienced a reduced risk of road traffic accidents compared to men. However, gender disparities in home-leisure accidents were observed to be age-dependent. Women under the age of 25 exhibited a lower likelihood of home-leisure accidents and serious accidents necessitating hospital admission in comparison to their male counterparts. In contrast, women aged 65 and above had an increased likelihood of home-leisure accidents as opposed to men in the same age category.*

Conclusions*. The findings of this study highlight the importance of considering age and gender as significant factors in the occurrence of different types of accidents, offering insight into how injury rates vary between these demographic groups within Italy.*

[1] *Department of Biomedical and Neuromotor Science, Alma Mater Studiorum, University of Bologna, Bologna, Italy*
[2] *Department of Molecular and Developmental Medicine, University of Siena, Siena, Italy*

Annali di Igiene : Medicina Preventiva e di Comunità (Ann Ig)
ISSN 1120-9135 https://www.annali-igiene.it

Introduction

Injuries represent a significant source of morbidity and mortality globally, claiming approximately 1.35 million lives each year due to road traffic accidents alone. Beyond fatalities, an estimated 2000 to 5000 individuals experience non-fatal injuries daily, many leading to disabilities (1, 2). These injuries pose considerable economic and social ramifications, resulting in losses for individuals, families, and nations, in terms of health status, financial costs, loss of working days, etc. Consequently, injury prevention and mitigation emerge as critical public health priorities.

In Italy, the burden of injuries is exacerbated by the nation's dense population, coupled with a high prevalence of road traffic and domestic incidents. Even when they do not result in fatalities, such injuries contribute to increased healthcare expenditures, workday losses, and diminished quality of life for affected individuals and their families (3). Therefore, discerning the determinants of injury and pinpointing effective preventive measures are imperative for shaping the country's public health policy. Previous investigations have been conducted in Italy to describe the impact of alcohol and illicit drugs use on road accidents and injuries (4, 5). Although reporting differences in the number of alcohol and drug-positive female and male drivers, both the studies did not explicitly focus on gender differences in injury patterns.

Existing international literature has explored the potential of gender in injury risk, but a consensus regarding the susceptibility of men or women remains elusive, as some researchers have pointed out higher rates in males (6-8), while others have found higher rates in females or similar risks (7, 9). Furthermore, many studies rely on hospitalization data, potentially neglecting the full scope of injuries, especially those of lesser severity that do not necessitate hospital admission. This limitation could result in misjudging the true impact of injuries and hinder understanding of the various injury types and their determinants (10).

To address these gaps, the present study aims to examine the incidence of self-reported road traffic and home and leisure accidents in the Italian general population, with a particular focus on potential gender differences. Furthermore, should this gender gap be present, this study will aim to explore whether the difference is confirmed across age classes.

To the best knowledge of the authors, this study is the first of its kind in the Italian population and, by including self-reported injuries of lesser severity, it will offer a more accurate and nuanced perspective on Italy's injury landscape, ultimately informing gender-targeted prevention strategies and interventions.

Methods

1. Data source and sample

Data were retrieved from the third wave of the European Health Interview Survey (EHIS) conducted in all EU countries between 2018 and 2020 in order to obtain national data with a high degree of comparability among Member States. EHIS provides detailed information on health status, healthcare use and health determinants by population aged 15 and over, living in private households (11).

In Italy, the survey was performed in 2019 by the Italian Statistical Office in a representative sample of the Italian general population including approximately 22,800 households resident in 835 Italian municipalities of different sizes and spread across the whole country. The survey was administered through the Paper and Pencil Interview (PAPI) method (11).

2. Variables

2.1. Outcomes

Participants were asked in three separate questions whether they had experienced injuries at home, during leisure activities or from road traffic during the previous year (12). Home and leisure time accidents were combined into one variable, namely home-leisure accidents. Information on medical care received (hospital admission, medical care without hospital admission, no intervention needed) was only collected for the most severe injuries.

2.2. Covariates

Covariates, expected to be correlated to the outcomes, were chosen among socio-demographic and health variables.

Socio-demographic variables included: sex, age, which was divided into 7 categories (15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75+), education addressing the highest degree of education attained (none or elementary/primary education, middle school/ lower secondary education, high school/higher secondary education, university degree), occupation (employed, unemployed, retired, student, fulfilling domestic tasks, unable to work or other), type of household/ family composition (one-person, lone parent with

at least one child aged <25, couple with at least one child aged <25, couple without any children, other including couple and lone parents with children aged 25 or more), citizenship (Italian vs foreign), region of residence, degree of urbanization of the place of living (low, medium, high), density of population of the place of living (metropolitan area, <10,000 inhabitants, >10,000 inhabitants).

Among health variables, we included: self-perceived general health rated on a 5-point Likert scale (very good, good, neither good nor bad, bad very bad), presence of chronic conditions (yes, no), long-standing Limitations in activities because of health problems (severe limitations, mild limitations, no limitations), body mass index (Kg/m2). In addition, we considered the presence of functional limitations and depressive symptoms. Functional limitations were quantified based on the level of difficulty (no, some, a lot, unable to do) experienced in performing 6 actions: seeing, hearing, walking on level ground, walking up and down, remembering and concentrating. Because of a few observations, the last two categories ("a lot of difficulty" and "unable to do") were collapsed into one. Depressive symptoms were measured with the 8-item Patient Health Questionnaire (PHQ-8). Each item explores the presence of symptoms in the two weeks preceding the interview, with possible answers: "not at all" [0], "several days" [1], "more than half days" [2], "nearly every day" [3]. A depressive symptoms severity score was calculated as the sum of the items' scores.

2.3. Statistical analysis

The main analysis was conducted using the sample with complete data on the selected variables. Missing data were then imputed using the multiple imputation technique and the statistical analysis was then replicated on imputed data, as a sensitivity analysis, to verify robustness of findings.

Multiple imputation consists in imputing missing data with a set of possible values allowing for the uncertainty about the missing data (13). Specifically, several different plausible imputed datasets are created, the statistical analysis is performed on each of them, and the results are appropriately combined. In our analysis we created 30 imputed dataset using multivariate imputation by chained equation (MICE) method. MICE procedure imputes missing data in a dataset through an iterative series of predictive models (14). In each iteration, each variable in the dataset is imputed using the other variables as predictors. The process (each iteration) starts imputing the variable with the lowest number of missing values and continues till all the variables with missing data are imputed. These iterations are run until it appears that convergence in estimates has been met.

Data were summarized using frequencies for categorical variables and median with interquartile range [IQR] for ordinal variables. Comparison between two groups (e.g., included and excluded patients, males and females) was done by means of Chi-squared test and Wilcoxon-Mann-Whitney test for categorical and ordinal variables, respectively. However, because the high sample size affects the significance level, a measure of the strength of association was also used. Specifically, the phi coefficient (phi) was used for dichotomous variables, the Cramer's V coefficient was used for categorical variables with >2 categories, and the point-biserial correlation coefficient (pbc) was used for continuous variables. An association was considered present if the coefficient was higher than 0.1.

The proportion (i.e., incidence) of accidents was computed among females and males and compared using Odds Ratio (OR) with 99% Confidence Interval. An OR greater than 1 indicates a higher proportion in females, while an OR lower than 1 indicates a lower proportion in females as compared to the male counterpart. In order to pick up the age effect, a logistic regression model was run for each outcome variable including age, gender and their interaction as independent variables. A significant interaction term was indicative of a non-homogeneous gender effect across age classes; an OR for each age class was reported to show the differences. In addition, a multivariable model including all the other covariates was estimated to adjust for the effect of possible confounding factors.

The statistical analysis was performed using Stata version 15 (StataCorp, College Station, TX) and the significance level was set for $p<0.01$.

Results

1. Sample description and comparison between males and females

The EHIS database included 45962 people, among which 875 (1.9%) did not answer injury questions and other 537 had missing values on the selected variables. Therefore, 1412 (3.1%) people were excluded from the main analysis. Included and excluded people were compared with respect to socio-demographic variables (Supplemental Table S1). The variable for which

the two groups differed most was age, with a higher proportion of young (<35 years) and old (>75 years) in the excluded group, but the association coefficient was lower than 0.1 suggesting a minor difference.

Between males and females there were also significant differences with respect to education, occupation, BMI, perceived health, functional limitations in walking and depressive symptoms (Table 1 and Table 2). Specifically, among women there was a higher frequency of people with elementary degrees but also a slightly higher frequency of graduates. In addition, women were more often housewives (26.2 vs

Table 1 - Comparison between Males and Females regarding socio-demographic characteristics.

Feature	M (N=21123) %	F (N=23427) %	Overall (N=44550) %	p-value, coefficient of association[$]
Age				p<0.001,V=0.060
15-24	11.5	9.5	10.5	
25-34	10.6	9.7	10.1	
35-44	13.9	13.6	13.7	
45-54	18.8	18.5	18.7	
55-64	17.3	16.9	17.1	
65-74	14.9	15.0	14.9	
75+	13.0	16.8	15.0	
Formal education				p<0.001, V=0.098
Primary school	13.3	19.8	16.7	
Secondary school	33.6	28.4	30.9	
High School Diploma	38.5	35.4	36.9	
Academic degree	14.6	16.4	15.5	
Job				p<0.001, V=0.382
Employed	51.5	35.3	42.9	
Unemployed	8.8	7.5	8.1	
Retired	28.9	20.5	24.5	
Student	8.2	7.9	8.1	
Home-Worker	0.1	26.2	13.8	
Invalid	2.5	2.7	2.6	
Household				p<0.001, V=0.086
Single	14.3	18.7	16.6	
Single parent with child*	3.2	5.4	4.4	
Couple with child*	33.6	29.5	31.5	
Couple without child*	22.0	20.0	20.9	
Other	26.9	26.4	26.6	
Italian Citizenship	95.2	94.3	94.8	p<0.001, phi=0.021
Residency Area				p=0.909, V=0.005
North-West	23.2	23.4	23.3	
North-East	20.6	20.3	20.5	
Center	19.2	19.1	19.1	
South	26.3	26.3	26.3	
Isles	10.7	10.9	10.8	
Municipality				p=0.005, V=0.016
Metropolitan Area	22.8	23.3	23.1	
<= 10’000 inhabitants	36.6	35.1	35.8	
>10’000 inhabitants	40.6	41.6	41.1	
Urbanization degree				p=0.002, V=0.017
Low	28.8	30.0	29.5	
Medium	44.0	44.1	44.0	
High	27.2	25.9	26.5	

Note: *child <25 years old; [$] coefficient of association is: phi coefficient for dichotomous variables (phi), Cramer V coefficient for categorical variables with >2 categories (V), point-biserial correlation coefficient for continuous variables (pbc).

Table 2 - Comparison between Males and Females regarding health determinants

Feature	M (N=21123) %	F (N=23427) %	Overall (N=44550) %	p-value, coefficient of association[$]
Perceived health				p<0.001, V=0.096
Very good	24.4	18.7	21.4	
Good	48.7	46.8	47.7	
Neither good nor bad	20.3	24.8	22.7	
Bad	6.6	9.7	8.2	
Chronic illnesses	29.5	34.8	32.3	p<0.001, phi =0.057
Limitations in activities of daily living				p<0.001, V=0.064
No	78.0	72.7	75.2	
Mild	15.7	18.6	17.2	
Severe	6.3	8.7	7.6	
Difficulties in seeing				p<0.001 , V=0.060
No	82.9	78.3	80.5	
Mild	15.6	19.3	17.6	
Severe	1.5	2.4	1.9	
Difficulties in hearing				p=0.001, V=0.018
No	77.8	76.4	77.1	
Mild	18.3	19.3	18.8	
Severe	3.9	4.3	4.1	
Difficulties in walking				p<0.001, V=0.107
No	90.8	83.6	87.0	
Mild	4.9	8.4	6.7	
Severe	4.3	8.0	6.2	
Difficulties in going up or down stairs				p<0.001, V=0.114
No	89.9	81.9	85.7	
Mild	5.9	10.1	8.1	
Severe	4.2	8.0	6.2	
Difficulties in remembering or focusing				p<0.001, V=0.084
No	85.8	79.6	82.5	
Mild	12.1	16.9	14.6	
Severe	2.1	3.5	2.8	
Depressive symptoms (score)	0 [0 – 2]	1 [0 – 4]	1 [0 – 3]	p<0.001, Pbc=0.137
Depressive symptoms (classes)				p<0.001, V=0.157
None-minimal (score 0-1)	67.2	53.1	59.8	
Mild (score 2-3)	17.4	20.5	19.0	
Moderate (score 4-8)	11.2	18.1	14.8	
Severe (score>8)	4.1	8.4	6.3	
BMI				p<0.001, V=0.195
Underweight	1.6	6.2	4.0	
Ideal weight	45.6	57.6	51.9	
Overweight	41.0	25.9	33.1	
Obese	11.8	10.4	11.1	

Note: *child<25 years old; [$] coefficient of association is: phi coefficient for dichotomous variables (phi), Cramer V coefficient for categorical variables with >2 categories (V), point-biserial correlation coefficient for continuous variables (pbc).

Table 3 - Proportion of people reporting to have had an accident during the past 12 months, divided by gender. Results are reported as proportions and Odds ratio of female vs male with 99% CI.

	M (N=21123)	F (N=23427)	p-value	OR (99% CI)
Any accident, N % (99% CI)	1476 7.0% (6.5 – 7.5)	1643 7.0% (6.6 – 7.5)	0.916	1.00 (0.91 – 1.10)
Home/leisure accident, N % (99% CI)	1067 5.1% (4.7 – 5.5)	1304 5.6% (5.2 – 6.0)	**0.016**	**1.11** **(0.99 – 1.24)**
Road accident, N % (99% CI)	443 2.1% (1.9 – 2.4)	375 1.6% (1.4 – 1.8)	**<0.001**	**0.76** **(0.63 – 0.91)**
Hospitalisation for an accident, N % (99% CI)	363 1.7% (1.5 – 2.0)	404 1.7% (1.5 – 2.0)	0.961	1.00 (0.83 – 1.21)

0.1 of males), which accounted for lower employment and retirement rates among women. Women reported a worse perceived health, particularly indicating a higher difficulty in walking on level ground and up and down, as well as a higher level of depressive symptoms (1 [0 – 4] vs 0 [0 – 2] of males). However, they were less frequently overweight compared with males. The association coefficients were all low (<0.2).

2. Incidence of accidents, overall and across gender and age classes

Overall, 7.0% (N=3119) of the sample reported to have experienced an injury in the previous year. Specifically, the incidence of home-leisure accidents was 5.3% (99% CI: 5.1 – 5.5), road traffic accidents was 1.8% (99% CI: 1.7 – 2.0) and of accidents requiring hospitalization was 1.7% (99% CI: 1.6 – 1.8). There was a significant difference between males and females with respect to the incidence of home-leisure and road traffic accidents. Specifically, women reported a higher incidence of home-leisure accidents and a lower incidence of road traffic accidents (Table 3). No difference was found with respect to the incidence of severe accidents requiring hospitalization.

When considering age, we found a significant variation in the effect of gender across different age classes for home-leisure accidents (p<0.001). Young women (<25 years) had a significantly lower probability of accident (OR=0.57, 99% CI 0.42 – 0.78), while women older than 55 years had a higher probability of reporting a home-leisure accident as compared to their male counterpart (Table 4). Similarly, young women also had a lower probability than young males to report an accident requiring hospitalization (OR=0.50, 99% CI: 0.28 – 0.88). Conversely, no significant difference across age classes was found with respect to the OR of road-traffic accidents (p=0.045).

In the multivariate analysis, women resulted at a

Table 4 - Logistically adjusted Odds Ratios of Females vs Males, stratified by age group.

Age	Home/Leisure time Injuries				Road Injuries				Hospitalized due to injury			
	OR	OR_l	OR_u	p-value	OR	OR_l	OR_u	p-value	OR	OR_l	**OR_u**	**p-value**
<25	0.523	0.379	0.721	**<0.001**	0.755	0.465	1.225	0.135	0.450	0.252	0.805	**<0.001**
25-34	0.680	0.464	0.998	**0.010**	0.661	0.392	1.113	**0.041**	0.657	0.319	1.351	**0.134**
35-44	0.704	0.496	1.000	**0.010**	1.092	0.652	1.829	0.661	0.522	0.257	1.061	**0.018**
45-54	0.795	0.601	1.052	**0.035**	0.903	0.599	1.360	0.521	0.619	0.364	1.051	**0.020**
55-64	1.276	0.954	1.706	**0.031**	0.683	0.434	1.076	**0.031**	0.906	0.551	1.490	0.609
65-74	1.358	0.994	1.853	**0.011**	0.512	0.281	0.935	**0.004**	1.308	0.776	2.205	0.186
75+	1.348	1.025	1.773	**0.005**	0.422	0.219	0.814	**0.001**	1.067	0.716	1.591	0.674

lower probability of road traffic accidents, regardless their age (adjusted OR=0.74, 99% CI: 0.61 – 0.91), while there were significant differences between age classes with respect to the OR of home-leisure accidents (p<0.001) and severe accidents requiring hospitalization (p=0.004). As depicted in Figure 1, young women (<25 years) had a lower probability of reporting home-leisure and severe injuries, while women older than 65 years had higher probability of home-leisure accidents than their male counterparts.

Results of sensitivity analysis on imputed data were consistent with these, suggesting robustness of findings (data not shown).

Discussion

The present study aimed to examine the gender differences in the risk of road traffic accidents and home-leisure accidents among the Italian population. To achieve this, we utilized a representative sample from the Italian general population and employed rigorous statistical analyses to assess the associations between gender, age, and accident risk. The findings of our investigation can be an aid in understanding the risk factors associated with different types of accidents and for informing targeted public health policies and injury prevention strategies.

Results show that women had a lower risk of road traffic accidents regardless of their age, when compared to their male counterparts, confirming what was described by Camino Lopez et al. (15). The same Authors also reported that the accident rate recorded in working hours is much higher among men, while the commuting-related accident rates are higher among women than men, in both traffic-related injuries and nontraffic-related injuries. This observation may be attributed to various factors, such as differences in driving behavior, risk-taking tendencies, and occupational exposure to road traffic. Previous research has indicated that men, particularly younger men, are more prone to engage in risky driving behaviors, such as speeding, driving under the influence of alcohol, and not using seat belts, which could contribute to their higher risk of road traffic accidents (4). Furthermore, men may be more likely to work in occupations that involve driving or increased exposure to road traffic, such as transportation, construction, or delivery services, thus elevating their risk of road traffic accidents (16-18).

Conversely, gender differences in home-leisure accidents were found to vary depending on age. Our results indicated that women under the age of 25 were at a lower risk of home-leisure accidents compared to men of the same age group. This may be due to differences in the types of leisure activities and domestic responsibilities undertaken by younger men and women, as well as differences in their risk-taking behaviors and safety awareness. These results substantiate what was described by Byrnes et al., as well as Harris et al., who described risk tacking behaviors to be more likely in males than in females (19, 20).

However, the pattern shifts in older age groups, with women over the age of 65 exhibiting a higher risk of home-leisure accidents compared to men of

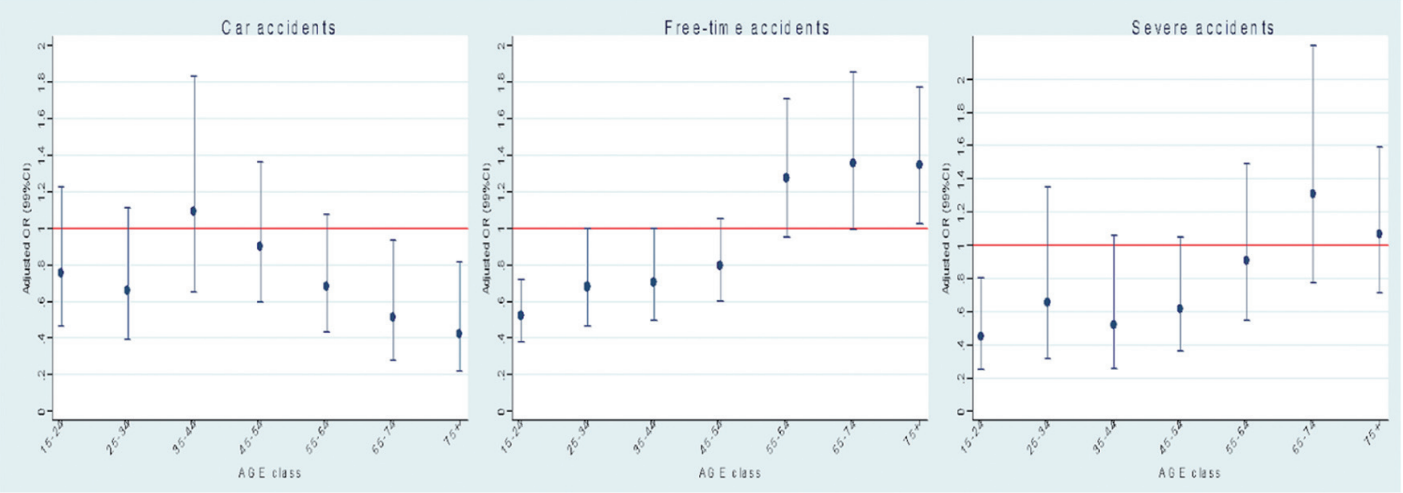

Figure 1 - Differences between Females and Males stratified by age group.

the same age group. This finding could be attributed to various factors, such as age-related declines in physical functioning, increased frailty, and differences in the types of activities and domestic responsibilities performed by older men and women (21, 22). Older women may be more likely to engage in activities that expose them to a higher risk of falls or other accidents, such as household chores or caregiving responsibilities. Additionally, the age-related decline in physical functioning and balance may exacerbate the risk of accidents among older women, who are more prone to developing conditions such as osteoporosis, which can increase their susceptibility to fractures and other injuries (23).

In a similar vein, our study revealed that women under the age of 25 have a significantly lower probability of experiencing severe accidents requiring hospitalization compared to men within the same age group. This finding supports the notion that younger women may be more cautious and safety-conscious in their daily activities and leisure pursuits, potentially resulting in a lower risk of severe injuries (24).

1. Strengths and limitations

The strengths of our study encompass the utilization of a representative sample from the Italian general population and the employment of rigorous statistical analyses, thereby bolstering the reliability of our findings. Moreover, by concentrating on Italy, our research sheds light on the distinctive cultural and societal context that could impact the gender differences observed in injury incidence.

Nonetheless, our study is not without limitations. Firstly, our analysis hinges on self-reported data, which is susceptible to recall bias and the potential underreporting of injuries, especially in the case of less severe accidents. Secondly, the cross-sectional nature of the data precludes the drawing of causal inferences between the observed factors and injury risk. In the Italian EHIS dataset, outcome variables pertain to events within the preceding 12 months, while many health variables reference the current situation, thus inhibiting conclusions regarding cause-effect relationships between current functional limitations, depressive symptoms, and outcomes. Future research adopting a longitudinal study design could provide deeper insights into the causal relationships between gender, age, and injury risk, while also investigating other factors that might contribute to these patterns.

To the best of our knowledge, this study is the first to investigate gender differences in road traffic and home-leisure accident incidence within the Italian population. Future research comparing these findings to those from other countries could reveal differences attributable to distinct socio-cultural contexts, further enriching our understanding of injury incidence and its underlying factors.

2. Practical applications

The outcomes of this study provide essential implications for public health policies and injury prevention strategies in Italy, underlining the significance of gender and age-related variations in the risk of road traffic and home-leisure accidents.

Our research confirms that men are at a higher risk of road traffic accidents across all age groups. Factors contributing to this disparity may include risk-taking driving behaviors, often more prevalent among men, especially younger ones, and occupational exposure in industries like transportation, construction, or delivery services (4, 16). This information can be used to design effective road safety education and training programs targeted specifically at male drivers, especially those in younger age brackets. These programs could focus on reducing risky behaviors, promoting responsible driving, and enhancing awareness about occupational hazards related to road traffic.

In contrast, gender differences in home-leisure accidents showed age-dependent variations. Younger women were less likely to have home-leisure accidents and severe accidents requiring hospitalization than their male counterparts, potentially reflecting greater safety consciousness in their activities (24). Nevertheless, the risk profile for older women shifts, with this group facing an increased risk of home-leisure accidents. Factors such as age-related declines in physical functioning, increased frailty, and potentially hazardous domestic responsibilities, such as household chores or caregiving, may play roles in this trend (23). Interventions aiming to decrease the incidence of home-leisure accidents among older women could focus on improving safety in domestic environments. This could involve raising awareness about common household hazards, providing safety equipment, and even modifying the domestic environment to reduce the risk of falls. Encouraging older women to engage in balance-enhancing exercises might also be beneficial, given the potential role of physical functioning declines in accident risk. The findings presented also shed light on the need for tailored interventions based on specific demographic characteristics. As such, future initiatives should incorporate age and gender-specific considerations in their design to address the distinct

risk factors associated with each demographic group effectively.

The Italian National Prevention Plan (PNP 2020-2025) dedicates to this theme the Predefined Strategy #05. Specifically, the PNP suggests combating home and road accidents through a multilevel and cross-discipline strategy that involves all the health services in the community, through integrated prevention actions and evidence-based interventions, aimed, among others, at monitoring the population perception regarding the risks and frequency of road and domestic accidents, and to promote safety with particular attention to the categories at greatest risk, including women and the elderly.

Additionally, it is crucial to further explore the unique societal and cultural factors within the Italian context that might influence these observed patterns. A deeper understanding of these factors can lead to the development of more precise and effective interventions, ultimately mitigating injury risk across different gender and age groups. Finally, evaluating the effectiveness of these targeted interventions is an essential next step, allowing us to refine strategies and make necessary modifications for the most impact. This study serves as a critical step towards achieving that goal, emphasizing the need for continued research in this domain.

Conclusions

This research highlights the importance of considering gender and age-related variations in injury risk when developing public health policies and injury prevention strategies. For instance, initiatives aimed at promoting road safety education and training programs targeted at young men could help reduce the risk of road traffic accidents in this population. Similarly, interventions focused on enhancing safety in domestic environments, such as raising awareness of common household hazards or providing safety equipment for older individuals, may help decrease the incidence of home-leisure accidents among older women.

As we move forward, it is imperative to further investigate the specific factors within the Italian context that may influence these observed patterns. This will allow us to develop more precise and effective interventions to mitigate injury risk across different gender and age groups. Evaluating the effectiveness of these targeted interventions is also a crucial next step. This study serves as a fundamental step towards that goal and underlines the necessity of continued research in this domain.

Acknowledgments: In loving memory of Dr. E.M., our first author for this manuscript. She was a cherished colleague, exceptional statistician, and devoted researcher who played a crucial role in shaping this article. Her intellect, passion, and steadfast dedication to scientific rigor have left a lasting impression on our work and approach to science. We are deeply grateful for her contributions and honored to have had the opportunity to collaborate with her. Dr. M.'s presence will be profoundly missed in our academic community, but her spirit will live on through her enduring impact on the field. To honor her memory, we have chosen to list her as the first author here, in the last article she worked on. Rest in Peace, E.

Declarations of interest: None.

Funding statement: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Riassunto

La distribuzione degli incidenti in Italia e la loro relazione con il genere

Introduzione. A livello globale, gli infortuni rappresentano una sfida significative per la salute pubblica. In particolare, gli incidenti stradali sono responsabili di elevata morbilità, mortalità e disagio economico. L'Italia è stata uno dei paesi più colpiti colpita a causa della sua alta densità di popolazione e della elevata frequenza di incidenti stradali e domestici.

Metodi. Questo studio si proponeva di indagare l'incidenza di incidenti stradali e domestici auto-segnalati nella popolazione italiana. È stata posta un particolare enfasi sull'esplorazione di possibili differenze di genere in diverse classi di età. I dati sono stati ottenuti dal *European Health Interview Survey* e le analisi sono state svolte su un campione rappresentativo della popolazione italiana.

Risultati. L'analisi ha rivelato che, indipendentemente dall'età, le donne hanno sperimentato un rischio ridotto di incidenti stradali rispetto agli uomini. Tuttavia, le disparità di genere negli incidenti domestici e in quelli legati al tempo libero, si sono rivelate dipendenti dall'età. Le donne di età inferiore ai 25 anni mostravano una probabilità minore di incidenti domestici e di incidenti gravi, necessitanti di ricovero in ospedale, rispetto ai loro coetanei maschi. Al contrario, le donne di 65 anni e più avevano una probabilità maggiore di incidenti domestici rispetto agli uomini della stessa categoria di età.

Conclusioni. I risultati di questo studio evidenziano l'importanza di considerare l'età e il genere come fattori legati all'incidenza di diversi tipi di incidenti, offrendo una panoramica su come le percentuali di infortuni variano tra gruppi demografici in Italia.

References

1. Chou PS, Huang SH, Chung RJ, Huang YC, Chung CH, Wang BL, et al. Gender Differences in the Epidemiological Characteristics and Long-Term Trends of Injuries in Taiwan from 1998 to 2015: A Cross-Sectional Study. Int J Environ

Res Public Health. 2022 Feb 22; **19**: 2531. https://doi.org/10.3390/ ijerph19052531. PMID: 35270224; PMCID: PMC8909776.
2. Haagsma JA, Graetz N, Bolliger I, Naghavi M, Higashi H, Mullany EC, et al. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. Inj Prev. 2016 Feb; **22**(1): 3-18. PMID: 26635210; PMCID: PMC4752630. https://doi.org/10.1136/injuryprev-2015-041616. Epub 2015 Dec 3.
3. Peden M, Scurfiled R, Sleet D, eds. World report on road traffic injury prevention. World Health Organization; 2004. Available on: https://apps.who.int/iris/handle/10665/42871 [Last accessed: 2023 July 11].
4. Barone R, Pelletti G, Garagnani M, Giusti A, Marzi M, Rossi F, et al. Alcohol and illicit drugs in drivers involved in road traffic crashes in Italy. An 8-year retrospective study. Forensic Sci Int. 2019; **305**: 110004. https://doi.org/10.1016/j.forsciint.2019.110004. PMID: 31707239.
5. Hels T, Lyckegaard A, Simonsen KW, Steentoft A, Bernhoft, IM. Risk of severe driver injury by driving with psychoactive substances. Accid Anal Prev. 2013 Oct; **59**: 346-56. https://doi.org/10.1016/j.aap.2013.06.003. Epub 2013 Jun 8. PMID: 23867258.
6. Al-Balbissi AH. Role of gender in road accidents. Traffic Inj Prev. 2003 Mar; **4**(1): 64-73. doi: 10.1080/15389580309857. PMID: 14522664.
7. Massie DL, Campbell KL, Williams AF. Traffic accident involvement rates by driver age and gender. Accid Anal Prev. 1995 Feb; **27**(1): 73-87. doi: 10.1016/0001-4575-(94)00050-v. PMID: 7718080.
8. Chipman ML, MacGregor CG, Smiley AM, Lee-Gosselin M. The role of exposure in comparisons of crash risk among different drivers and driving environments. Accid Anal Prev. 1993 Apr; **25**(2): 207-11. doi: 10.1016/0001-4575-(93)90061-z. PMID: 8471119.
9. Kweon YJ, Kockelman KM. Overall injury risk to different drivers: combining exposure, frequency, and severity models. Accid Anal Prev. 2003 Jul; **35**(4): 441-50. doi: 10.1016/s0001-4575(02)00021-0. PMID: 12729808.
10. Santamariña-Rubio E, Pérez K, Olabarria M, Novoa AM. Gender differences in road traffic injury rate using time travelled as a measure of exposure. Accid Anal Prev. 2014 Apr; **65**: 1-7. doi: 10.1016/j.aap.2013.11.015. Epub 2013 Dec 16. PMID: 24384384.
11. Istituto Nazionale di Statistica (ISTAT). Condizioni di salute e ricorso ai servizi sanitari in Italia e nell'Unione Europea - Indagine EHIS 2019, "Nota Metodologica". Available on: https://www.istat.it/it/archivio/265399 [Last accessed: 2023 July 11].
12. European Health Interview Survey (EHIS third wave) — Methodological manual. 2018. Available on: https://ec.europa.eu/eurostat/web/products-manuals-and-guidelines/-/KS-02-18-240 [Last accessed: 2023 July 11].
13. Sterne JA, White IR, Carlin JB, Spratt M, Royston P, Kenward MG, et al. Multiple imputation for missing data in epidemiological and clinical research: potential and pitfalls. BMJ. 2009 Jun 29; **338**: b2393. doi: 10.1136/bmj.b2393. PMID: 19564179; PMCID: PMC2714692.
14. Azur MJ, Stuart EA, Frangakis C, Leaf PJ. Multiple imputation by chained equations: what is it and how does it work? Int J Methods Psychiatr Res. 2011 Mar; **20**(1): 40-9. doi: 10.1002/mpr.329.
15. Camino López MA, González Alcántara ÓJ, Fontaneda I. Gender Differences in Commuting Injuries in Spain and Their Impact on Injury Prevention. Biomed Res Int. 2017; **2017**: 3834827. doi: 10.1155/2017/3834827. Epub 2017 Nov 26. PMID: 29318145; PMCID: PMC5727637.
16. Bureau of Labor Statistics. Fatal occupational injuries by industry and event or exposure, all United States, 2019. U.S. Department of Labor; 2020. Available on: https://www.bls.gov/iif/oshcfoi1.htm [Last accessed: 2023 July 11].
17. Oreffice S, Sansone D. Commuting to work and gender-conforming social norms: evidence from same-sex couples. arXiv preprint arXiv:2202.10344 (2022).
18. Haranko K, Zagheni E, Garimella K, Weber I. Professional gender gaps across US cities. Proceedings of the Twelfth International AAAI Conference on Web and Social Media (ICWSM). 2018; **12**(1): 604-7.
19. Byrnes JP, Miller DC, Schafer WD. Gender differences in risk taking: A meta-analysis. Psychol Bull. 1999; **125**(3): 367-83. https://doi.org/10.1037/0033-2909.125.3.367
20. Harris CR, Jenkins M, Glaser D. Gender differences in risk assessment: Why do women take fewer risks than men? Judgment and Decision Making. 2006; **1***(*1): 48-63. https://doi.org/10.1017/S1930297500000346.
21. Angulo J, El Assar M, Álvarez-Bustos A, Rodríguez-Mañas L. Physical activity and exercise: Strategies to manage frailty. Redox Biol. 2020 Aug; **35**: 101513. doi: 10.1016/j.redox.2020.101513. Epub 2020 Mar 20. PMID: 32234291; PMCID: PMC7284931.
21. Campbell AJ, Spears GF, Borrie MJ. Examination by logistic regression modelling of the variables which increase the relative risk of elderly women falling compared to elderly men. J Clin Epidemiol. 1990; **43**(12): 1415-20. doi: 10.1016/0895-4356(90)90110-b. PMID: 2254780.
22. Bone Health and Osteoporosis Foundation (BHOF). Fast facts on osteoporosis; 2021. Available on: https://www.nof.org/preventing-fractures/general-facts/what-women-need-to-know/ [Last accessed: 2023 July 11].
23. Gao S, Chang C, Ren F, Yu F. Safety Culture Measurement Among Chinese Undergraduates at a Private University: Development and Validation. Front Public Health. 2022 Mar 28; **10**: 825106. doi: 10.3389/fpubh.2022.825106. PMID: 35419338; PMCID: PMC8995428.

Corresponding author: Francesco Sanmarchi, MD, Department of Biomedical and Neuromotor Sciences, University of Bologna, Via San Giacomo 12, 40126 Bologna, Italy
e-mail: francesco.sanmarchi@studio.unibo.it

Supplemental Table S1. Included and excluded people compared with respect to socio-demographic variables.

Feature	Included (N=44550) %	Excluded (N=1412) %	Overall (N=45962) %	p-value, coefficient of association[$]
Females	52.6	47.2	52.4	p<0.001, phi =0.019
Age				p<0.001, V=0.089
15-24	10.5	21.5	10.8	
25-34	10.1	17.1	10.3	
35-44	13.7	11.9	13.6	
45-54	18.7	12.5	18.5	
55-64	17.1	10.2	16.9	
65-74	14.9	7.2	14.7	
75+	15.0	19.7	15.2	
Formal education				p=0.001, V=0.019
Primary school	16.7	20.5	16.8	
Secondary school	30.9	30.4	30.9	
High School Diploma	36.9	33.2	36.8	
Academic degree	15.5	15.9	15.5	
Job				p<0.001, V=0.078
Employed	42.9	34.8	42.7	
Unemployed	8.1	10.1	8.2	
Retired	24.5	19.5	24.3	
Student	8.1	18.2	8.4	
Home-Worker	13.8	11.3	13.8	
Invalid	2.6	6.1	2.7	
Household				p<0.001, V=0.045
Single	16.6	10.9	16.4	
Single parent with child*	4.4	5.3	4.4	
Couple with child*	31.5	34.3	31.5	
Couple without child*	20.9	14.8	20.7	
Other	26.6	34.7	26.9	
Italian Citizenship	94.8	94.3	94.8	p=0.466, phi =0.003
Residency Area				p<0.001, V=0.025
North-West	23.3	20.8	23.2	
North-East	20.5	18.8	20.4	
Center	19.1	17.1	19.1	
South	26.3	29.0	26.4	
Isles	10.8	14.3	10.9	
Region of Residency				p<0.001, V=0.062
Municipality				p=0.163, V=0.009
Metropolitan Area	23.1	21.5	23.0	
<= 10’000 inhabitants	35.8	35.1	35.8	
>10’000 inhabitants	41.1	43.5	41.2	
Urbanization degree				p=0.030, V=0.012
Low	29.5	32.1	29.5	
Medium	44.0	44.0	44.0	
High	26.5	23.9	26.4	

Note: *child <25 years old; [$] coefficient of association is: phi coefficient for dichotomous variables, Cramer V coefficient for categorical variables with >2 categories, point-biserial correlation coefficient for continuous variables.