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Firearm ownership and suicide: Has the time come to discuss uniformity of health and social assessments in aid of regulation? Reflection from a retrospective study on a forensic case series

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Keywords: Suicide; firearm; license; forensic medicine; regulation; health prevention
Parole Chiave: Suicidio; arma da fuoco; licenza; medicina forense; regolamentazione; medicina preventiva

Abstract

Background. *Firearm-related deaths are an issue of ongoing public interest, from a health and economic perspective. Worldwide, firearm prevalence in suicides varies widely, depending on multiple factors including the availability of weapons in each country. Although several studies have shown that national laws about gun ownership, reducing legal access to guns, decrease the risk of suicide by firearm, the current situation clashes with widely differing legislations.*
Study design. *Retrospective study on a forensic case series.*
Methods. *Autopsy reports assessed at the Section of Legal Medicine of Milan (Italy) from January 2014 to December 2023 were retrospectively documented. Only firearm suicides were considered. For each case, a close analysis of the criminal offence reports has been performed to obtain information about the gender and age of the victim, as well as the legal possession of firearms, psychiatric disorders, alcohol, and illicit drug abuse.*
Results. *Among all the 1,164 suicides assessed at the Section of Legal Medicine of Milan over a 10-year-period, 101 cases (8.7%) were firearm-related. The male to female ratio was therefore about 13:1. No seasonal trends were observed. Most of the individuals owned the firearm license. Of the entire dataset, 35.6% suffered from psychiatric disorders, 4% of alcohol abuse and 2% of drug addiction. Among the owners of a firearm license, 42.3% had psychiatric disorders.*
Conclusions. *Knowledge about firearm suicide and its relation to firearm legal possession is limited and current preventive laws should be reconsidered. Present administrative and clinical examinations required to obtain a firearm license in Italy and in some European territories are dealt with. The evaluation of the firearm-related risk of abuse is an essential but complex procedure, which requires not only clinic-anamnestic data but also in-deep psychiatric information. There is a need to develop and reinvigorate a debate that currently presents very heterogeneous solutions, but which would probably benefit from a common vision of the prevention strategies that can be implemented and enacted for the benefit of the entire community.*

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Introduction

Suicide is a significant public health issue worldwide and its prevention is crucial for healthcare and the community (1). A recent (2023) review by Favril et al. (2) reported that mood disorders and psychotic disorders had the largest effect sizes within the psychiatric domain, and previous suicide attempts or self-harm were the strongest risk factor overall (2). Interestingly, this finding is consistent with previous research on suicides in the Milan metropolitan area, where psychiatric diseases have always been considered as significant risk factors (3-5). In this regard, Favril et al. (2) reported that dementia was the only mental condition not associated with suicidal behavior. By contrast, sociodemographic factors such age, sex or marital status were moderately associated with suicide mortality. Worldwide, firearm prevalence in suicides varies widely, depending also on the acceptance and availability of firearms in each country (6). The use of firearms in suicides ranges from less than 5% in Japan to 50.5% in the U.S., where it is the most common method of suicide (7). Several studies have demonstrated that national laws, which reduce the access to guns at a population level, decrease the risk of suicide by firearms (8-11). Indeed, fewer people die from suicide overall in places with stricter laws regulating the purchase, trading and use of firearms. Suicide risk increases when firearms are more available. Knowledge about firearm suicide and its relation to firearm legality in the European setting is limited and studies are scarce (12-13). A reflection on this issue is proposed, starting from the analysis of the trend of firearm-related suicides over a 10-year period in an area of interest in Italy, consisting of the Milan metropolitan area.

In Italy, the possession of weapons is extensively regulated: there are different types of licenses which follow specific administrative and clinical trials in relation to firearms and their use (14-15).

Rifle license for skeet. The license is issued by the central police station; it also authorizes the transport of the gun for the shooting range. The validity is set up to 5 years and can be revoked for public safety reasons.

Rifle license for hunting. The license is issued by the central police station; it also authorizes the transport of the gun. The validity is set up to 6 years and can be revoked for public safety reasons.

Handgun license for personal defense. The license is issued by the prefecture only in selected cases with mandatory justifications: the decision is purely discretional. The license also authorizes the transport of the gun. The validity is set up to 5 years but with annual renewal.

Rifle license for personal defense. The license is issued by the central police station only in selected cases with mandatory justifications: the decision is purely discretional. The police commissioner can reject the license request if the candidate has been convicted for violent crimes. The license also authorizes the use of handguns and the transport of the firearms. The validity is set up to 5 years but with annual renewal.

Handgun license for security guards. The license is issued by the prefecture upon the request of the employer. The license also authorizes the use for personal defense and the transport of the gun. The validity is set up to 6 years but with biannual renewal.

License for firearms detention only. The license can be issued to anyone who provides the medical certificates for firearm detention. The validity of the medical certificate is set up to 5 years.

Every firearm license before being issued requires medical certifications. In the first place, the candidate must exhibit the anamnestic certificate which is compiled by the general practitioner. This examination aims to certificate the absence of psychiatric disorders, alcohol or illicit drug abuse, neurologic diseases, epilepsy, or mental disability (14). Of course, the presence of only one of such conditions rules out the possibility to obtain the license. In the second place, the candidate must exhibit a second certificate which is issued by a medicolegal consultant belonging to the Local Health Authority or by an Army physician. These experts assess the visual acuity and the hearing threshold; as for the general practitioner, they also certificate the absence of neuropsychiatric disorders based on anamnestic data. Other tests such as toxicological or biochemical examinations are facultative and requested occasionally by the medicolegal consultant.

Therefore, the present study sought to analyze whether the suicide victim population in the Milan metropolitan area included individuals in legal possession of weapons, as well as the presence of psychiatric disorders, alcohol, or illicit drug abuse conditions. Furthermore, the authors discuss the administrative and clinical examinations which are needed to obtain a gun license in Europe, with a focus on potential prevention strategies and regulations to reduce firearm-related suicides which are potentially applicable worldwide.

Methods

6,661 autopsy reports assessed at the Section of Legal Medicine of Milan (Italy) from January 2014 to December 2023 were retrospectively documented. A total number of 1,164 suicides were collected, and then reported per year. The list of analyzed cases was based on internal database search; among them, only firearm suicides were considered. For each case, we performed a close analysis of the criminal offence reports which could provide information about the gender and age of the victims. The reports were also informative on the legal detention of the firearms (license) that were used for suicides. Further data were collected by interviewing the victims' relatives before the autopsy examination as well as by analyzing the clinical documentation that was still available. Therefore, we examined the personal medical history of the victims with a specific focus on psychiatric disorders, conditions of alcohol or illicit drug abuse. For statistical analyses and graphics SPSS Statistics 29.0.1.0 has been used.

Results

Among all the 1164 suicides assessed at the Institute of Legal Medicine of Milan over a 10-year-period, 101 cases (8.7%) of firearm-related suicides occurred. There were 94 males (93.1%) and 7 females (6.9%); the male to female ratio was therefore about 13:1. By dividing all cases into groups of 20 years, there were only 12 victims (11.9%) under 40 years of age, 36 victims (35.6%) between 41 and 60 years old, 36 (35.6%) victims between 61 and 80 years old, and 17 victims (16.8%) over 81 years of age. No seasonal trends were observed. Fig. 1 and Fig. 2 show the temporal trend of firearm-related suicides. Almost all the deceased were Italian (97%), with only 3 cases of foreigners observed (one German, one Chilean and one from the Czech Republic). Fig. 3 shows the distribution of work activities in the analyzed dataset: most of the subjects were retired, but among those in employment the most represented included law enforcement personnel (17.8%), of whom 94.4% were male.

Regarding the detention of the firearm used, in 10 reports there was no information about its legal possession. Out of the remaining reports, 79 individuals (86.8%) owned the firearm license, which means that they were considered suitable for the possession and/or use of the firearm; in 4 cases the weapon was held by a family member (4.4%) and in 8 cases (8.8%) the weapon was held illegally.

Furthermore, 38 cases (37.6%) suffered from at least one of a) psychiatric disorders (36 cases, 35.6%), b) alcohol abuse (4 cases, 4.0%), and c) drug addiction (2 cases, 2.0%). Specifically with regard to those suffering from psychiatric disorders, 75% had a history of major depression and 11.1% of anxiety disorder. Among those who owned a firearm license, 42.3% were found to have a psychiatric disorder, of whom depression accounted for 72.7% of cases.

Applying the chi-square test, no significant associations were found between the variables analyzed (possession of firearm license, psychiatric disorders, drinking habits and drug addiction).

Discussion

Suicide is a global health burden which accounts for over 1 million deaths per year worldwide. In the U.S., the leading suicidal method is represented by firearms, which is typically committed by white males over 50 years of age (16-17). The firearm license is owned by the victims in the majority of cases. A recent study by Chao et al. highlighted a significative correlation between the density of federal firearm licenses in the U.S. and the firearm-related suicide rate in the same area, without any correlation for firearm-related homicides (18). Therefore, the authors reported that specific laws on the possession of firearms, which are based on the evaluation of previous crimes and psychiatric disorders, affect the total number of firearm-related suicides. Moreover, the study pointed out that the lowered number of firearm-related suicides is associated with a global decrease of the number of all suicides (18). Boggs et al. documented that among 2,674 adults during 2000-2013 who committed suicide in the U.S., more than half of them (54.7%) suffered from alcohol or illicit drug abuse or other psychiatric disorders, and 42.8% of them committed suicide by using firearms (19). These data support the evidence that people suffering from psychiatric conditions show higher risks of firearm-related suicides (20-21). Furthermore, the lethality rate of the firearm-related suicides is higher compared with other detrimental methods such as drowning, hanging, and poisoning (22-23). As a result of this, the restriction to own firearms may be a possible strategy to decrease firearm-related deaths. Notably, firearm-related suicides include deaths among law enforcement officers. These events have

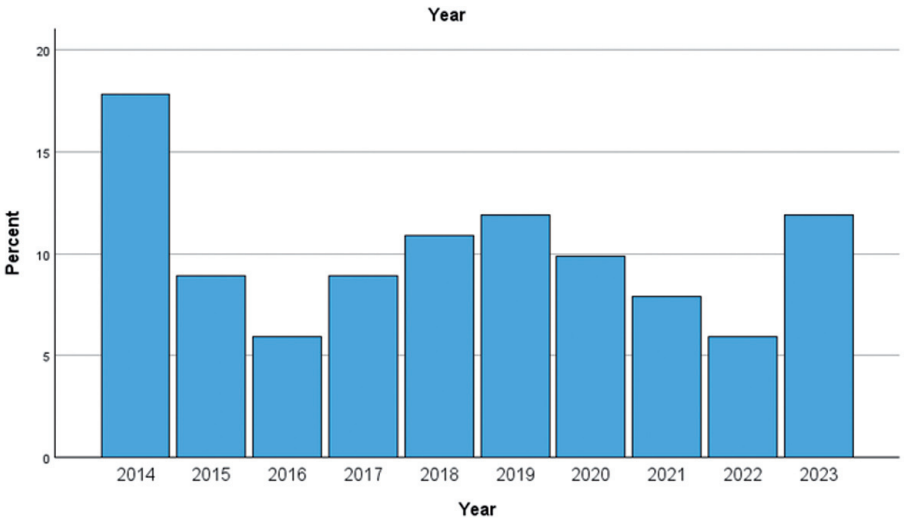

Figure 1 - Annual trend of firearm-related suicides in Milan from 2014 to 2023.

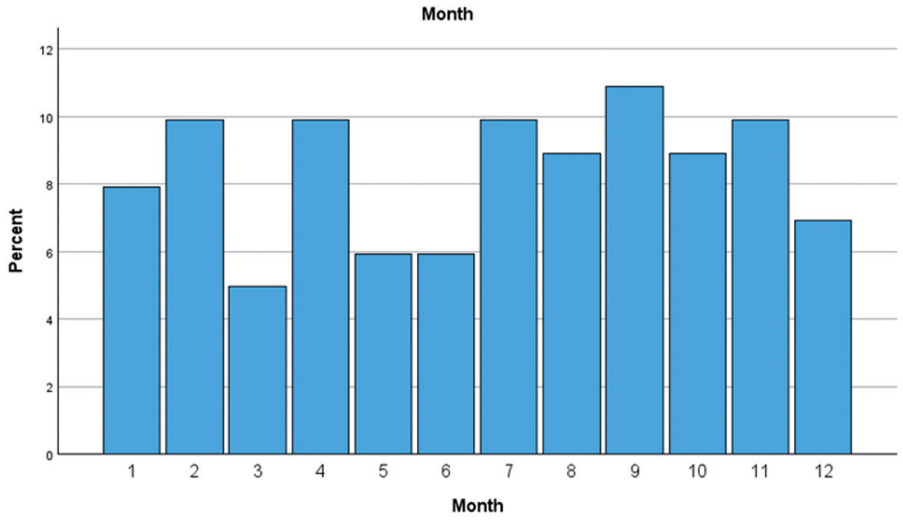

Figure 2 - seasonal trend of firearm-related suicides in Milan from 2014 to 2023.

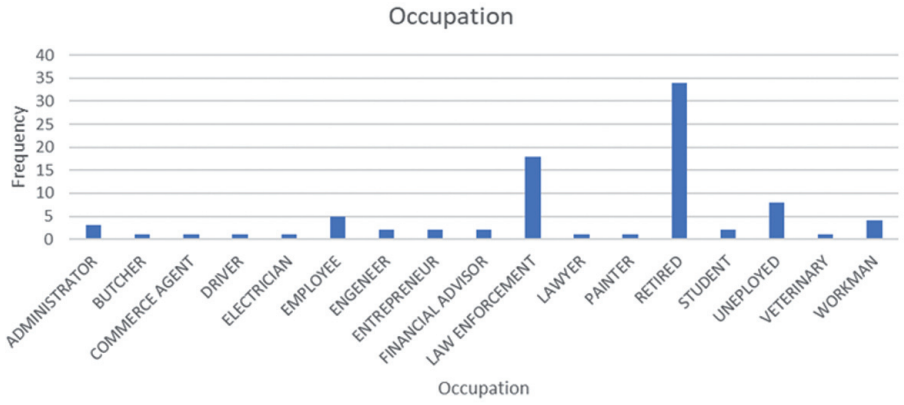

Figure 3 - distribution of work activities in the analyzed dataset.

been poorly studied but they have been reported all over the world and have raised important social issues. Police officers have been considered at increased risk of suicide (24): even though a study published by Marzuk et al. (2002) reported that the suicide rate from 1977 up to 1996 among New York City police officers was equal to, or even lower than, the suicide rate of the city's resident population (25). On the other hand, Grassi et al. (2019) reported that suicide rates among Italian police officers were significantly higher than those of the national resident population over a long and more recent observation period, i.e. from 1995 to 2017 (26). Similar results were assessed in a Portuguese study where the authors emphasized the widespread use of firearms to commit suicide (34 cases out of a total number of 39 victims) (27). These events should be observed less frequently than in the general population, given that police officers usually undergo psychological tests for the issuance of firearm license. However, it has also been underlined that these individuals can experience very stressful situations, emotional distress or other traumatic conditions which are less present in the majority of the rest of the population: in such circumstances, easy access to a firearm may be a relevant aspect (24). Therefore, a comprehensive psychological examination should be a crucial aspect of the recruitment process and be extended over a scheduled period among law enforcement officers. This procedure can detect potential suicidal behavior or psychological alterations, allowing for the therapeutic intervention and the temporary suspension of the firearm license if necessary.

In Europe and in other countries, male suicides by using firearms are less frequently reported than in the U.S. Therefore, several studies focused on the relationship between the availability of firearms and the suicide rates, highlighting that a more restrictive legislation on the possession and use of firearms can be considered as an efficient tool to decrease the number of suicides (28). For instance, no one in Japan may purchase a handgun or a rifle other than the police and the military. Hunters and target shooters may possess shotguns and airguns under strictly circumscribed conditions (29). Accordingly, the firearm-related suicide rate in Japan is estimated at 0.36 per million (30). Similar results have been observed in other countries such as Canada, United Kingdom, Austria, Australia, and New Zeeland and which have introduced stricter rules for the acquisition of the firearm license (31-35). Specifically, precautionary measures included the mandatory registration of all firearms and the exact indication of their use, the increase of the minimum age to obtain the license as well as of prohibited firearms, the reduction of the license temporal validity, and periodic meetings with the firearms' owners (36). The Austrian Government has increased the minimum age to 21 years and has introduced, since 1997, psychometric tests and periodic retrospective controls on the candidates. Birner demonstrated that this new Austrian legislation significantly decreased the number of firearm-related suicides among women between 20 and 65 years, and among all groups of men over 20 years (37). On the other hand, the firearm-related suicide rate in Switzerland can be considered high and it is estimated at 57.4 per million despite more regulation than the U.S. (13,38). This phenomenon has been explained by the fact that most adult men belong to the National Swiss Army and owns necessarily a firearm at home. However, as for Austria, Reisch et al. observed a reduction of suicide rates in Switzerland after firearm restriction resulting from the 2003 Army XXI reform (13). This reform included the discharge age from 43 to 33 and the reduction of manpower from 400,000 to about 200,000 personnel, with 120,000 receiving periodic military training and 80,000 reservists who have completed their total military training requirements. Furthermore, the reform established the necessity of a gun license and an increase in fee for soldiers who decide to purchase their gun after service.

A brief list of European countries including Italy whose firearm regulations are easily recoverable and clearly explained is presented in Table 1 (14,15,37,39-44), to indicate the non-uniformity of assessment.

Noteworthy, our research showed a clear predominance for male sex (94 out of 101 cases) and subjects over 40 years of age; these results are similar to what has been already observed in the U.S. and in other European countries (13,17,19,45-46). This research also showed that the majority of the victims (86.8%) has been judged as suitable for the possession and/or use of a firearm although suffering from psychiatric disorders (42.3%) or alcohol abuse (4%) at the moment of death. In one case, concerning a subject who suffered from depression, drug use was also detected. These results highlight a thorough revaluation of the effectiveness and appropriateness of the psychophysical standard before the issue of the license (47) as well as regular revaluations. Therefore, there are physical prerequisites such as the visual ability and the hearing threshold that can be measured objectively without any possibility of error. On the other hand, some psychiatric conditions such

Table 1 - European countries' firearm regulations (Italy is included).

Country	Requisites for firearms use	Level of restriction
Italy	Every firearm license before being issued requires medical certifications. Handgun and rifle licenses for self-defense can be issued to individuals of legal age; a second medicolegal assessment is necessary to evaluate the candidate. The final decision is discretional, and licenses need annual renewal. Licenses for skeet and hunting are issued after a medicolegal assessment and can be revoked anytime for safety public reasons. License for firearms detention only can be issued to anyone who provides the medical certificate with a validity of 5 years.	High (14,15)
Austria	All Austrian citizen over 18 can buy firearms from categories C without a permit after a three-day background check. They need to be registered six weeks after purchase. The law requires the owner to provide a good reason such as self-defense at home, hunting, sport shooting and collection, during registration. Purchase of category B weapons requires a firearm license. Authorities shall issue license to any non-prohibited citizen of European Economic Area over 21 who has a good reason. Category A requires further exceptions to be granted.	Medium (37)
France	All French citizen over 18 can purchase category D arms (black powder firearms designed before 1900 and compressed air arms). Category C firearms (e.g., shotguns, manual repeating rifles) can be obtained with a hunting license, or sport-shooting license with a medical certificate. Category B firearms are only available to sport-shooters licensed for at least 6 months, with a medical certificate, without felony convictions, and additionally requires at least three shooting sessions with an instructor each separated by 2 months. Category A special firearms (e.g., military arms) purchase not allowed.	High (39)
Germany	Weapon possession card and firearm license (to use or carry a loaded weapon). The license is issued by the police in selected cases: when the applicant can prove that they are in greater danger than the general public and that carrying a gun will keep them safer. A medical certificate for mental aptitude and no dependence from alcohol or illicit drugs is necessary if under 25 applying for their first gun license. A specialized knowledge of guns and a liability insurance for personal injury and property damage of at least €1 million is also required.	High (40)
Spain	A firearm license for rifles and shotguns may be obtained from the Guardia Civil after passing a police background check, a physiological and medical test, and a practical and theoretical exam. A sports license requires proof of sports activity of at least one competition each year. Police may inspect firearms at any time. A self-defense license is only available under special conditions.	Very high (41)
Sweden	Firearm licenses for hunting and sports shooting are issued by the police; it is also necessary to pass a hunting examination or membership in an approved sports shooting club for six months. Self-defense with firearms, as well as carry, is generally prohibited. Permits to carry firearms can be issued by the police under very special circumstances like an immediate and proven life threat.	Very high (42)
Switzerland	Purchase of firearms is allowed without permits. Some categories of arms are banned such as fully automatic guns.	Low (38,43)
United Kingdom	Firearm certificate for shotgun and sports rifles is issued from the local police force. Other firearms (e.g., handguns) require explicit permission from central government.	Very high (44)

as depression, anxiety and personality disorders may be difficult to be appreciated by general practitioners and medicolegal specialists (48). In such contexts, the candidates may dissimulate psychiatric disorders on purpose or may not realize that they suffer from these pathological conditions. Moreover, these diseases are still today considered as social stigma, and this situation further limits the possibility to make a correct diagnosis and treatment. These considerations provide the necessity to improve the clinical trial for the issue of firearm licenses; specifically, our results suggest integrating psychometric tests or psychiatric interviews. Of course, the aim of these diagnostic tools is to investigate the individual and familial psychopathological anamnesis, changes in the mood, emotions, or feelings, recent traumatic or stressful events, the personality of the individual, and situations of self-inflicted violence. Noteworthy, some Italian prefectures and central police stations have recently requested that the medicolegal practitioner obtains integrative evaluations for the firearm license, which included mandatory psychiatric interview as well as alcohol and drug tests.

Our results postulate another relevant consideration regarding the validity of the firearm license. Every license establishes a specific temporal validity which is age-independent and cannot be modified. However, the psychophysical prerequisites are subject to negative modifications which increase proportionately with aging; thus, a 5-years validity of a firearm license (e.g., rifle license for hunting) cannot be considered as suitable for the older population. Recently, the Friuli-Venezia Giulia Regional Administrative Tribunal (T.A.R.) has rejected the appeal of a citizen after that the central police station had declined the issue for a rifle license for hunting (49). Specifically, the medicolegal practitioner did not confirm the full validity of the medical certificate, lowering it up to 1 year with a mandatory reviewability, since the psychophysical prerequisites were not completely satisfied. The court stated that public safety is a right which is much more important than the individual possibility of detection/use of firearms; in fact, this faculty must be subordinated to the full and certain security of their use. Furthermore, our study observed that the most firearm-related suicides involved people over 61 years of age. As a consequence of this, these people would benefit from more extensive psychiatric examinations, which should also be more frequent over the years so as to detect organic modifications. A potential way to resolve this situation may come from the system in force for the driving license (50). In our country, the law establishes a normal validity of 10 years up to 50 years of age, then 5 years up to 70, 3 up to 80, and finally every 2 years over 80 years of age. The medicolegal practitioner can also reduce at any age the validity for specific pathological conditions. Mandatory possession of an insurance policy could be an additional element of social and protective interest. It might be useful to discuss the possibility of reporting the presence of a firearms license in health records accessible by the doctors treating the person, so that they have this information and can report any changes in health that might lead to the advisability or need for a review of the license.

Conclusion

In conclusion, the evaluation of the firearm-related risk of abuse is an essential but complex procedure, which requires not only clinic-anamnestic data but also deeper psychiatric information. Additionally, the European debate regarding the possession and use of firearms is quite poor, and it is worthy of more attention considering the results presented herein.

There are of course limitations in the present work. In the first place, the scarcity of available data, as it comes from a limited geographical area and therefore cannot be directly extended to the whole territory, an element that does not allow the observed data to be generalized. In addition, it was not possible to obtain further relevant elements, such as the presence of previous suicide attempts, unfavorable environmental and economic conditions, as well as the severity of any organic pathologies, which could have further emphasized the need for a more precise control of the subject. A national and supranational register on the topic would also be useful for the discussion on the diffusion of weapons in the population and its consequences.

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Ethical statements
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Conflict of interest: none.
Ethical approval: not applicable.
Consent to participate: not applicable.

Riassunto

Possesso di armi da fuoco e suicidio: È giunto il momento di discutere sull'uniformità delle valutazioni sanitarie e sociali a sostegno della regolamentazione? Riflessione da uno studio retrospettivo su una serie di casi forensi

Premessa. I decessi correlati alle armi da fuoco sono un problema di interesse pubblico costante, sia dal punto di vista sanitario che economico. In tutto il mondo, la prevalenza delle armi da fuoco nei suicidi varia ampiamente, a seconda di molteplici fattori, tra cui vi è la disponibilità di armi sul territorio. Sebbene diversi studi abbiano dimostrato che le leggi nazionali sul possesso di armi, riducendone l'accesso, diminuiscano il rischio di suicidio con arma da fuoco, la situazione attuale vede legislazioni e regolamentazioni eterogenee.

Disegno dello studio. Ricerca originale.

Metodi. Sono state valutate retrospettivamente le risultanze di accertamenti autoptici della Sezione di Medicina Legale di Milano (Italia), nel periodo compreso tra gennaio 2014 e dicembre 2023. Sono stati inclusi unicamente i suicidi da arma da fuoco. Per ogni caso, è stata effettuata l'analisi delle informative delle Forze dell'Ordine per ottenere notizie sulla detenzione legale delle armi da fuoco nonché sul sesso, sull'età e sulla presenza di disturbi psichiatrici, abuso di alcol e di droghe delle vittime.

Risultati. Tra i 1.164 suicidi valutati presso la Sezione di Medicina Legale di Milano in un periodo di 10 anni, si sono verificati 101 casi (8,7%) di suicidi legati alle armi da fuoco. Il rapporto maschi/femmine è stato quindi di circa 13:1. Non sono state osservate tendenze stagionali. La maggior parte degli individui deteneva legalmente l'arma utilizzata. Dell'intera casistica, il 37,6% soffriva di disturbi psichiatrici, il 4% di abuso di alcol e il 2% di tossicodipendenza. Tra i possessori di porto d'armi, il 42,3% presentava disturbi psichiatrici.

Conclusioni. Poiché le conoscenze sul suicidio da arma da fuoco e sulla sua relazione con il possesso legale delle armi da fuoco sono limitate, è indicato discutere l'attuale legislazione preventiva. Partendo dai risultati di una *case series*, si illustrano gli esami amministrativi e clinici necessari per ottenere la licenza del porto d'armi in Italia e in alcuni territori europei. La valutazione del rischio di abuso delle armi da fuoco è una procedura essenziale ma complessa, che richiede non solo dati clinico-anamnestici ma anche informazioni psichiatriche approfondite. Occorre sviluppare e rinvigorire una discussione che ad oggi presenta soluzioni molto eterogenee, ma che probabilmente trarrebbe beneficio da una visione comune delle strategie di prevenzione che possono essere implementate e messe in atto a beneficio dell'intera comunità.

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