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A nationwide forensic case-series of femicides in Italy – Part 2: Clues to its epidemiology, prediction and prevention

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ABSTRACT

Femicides are grievous, but little is known about risk factors and preventive measures. We present the results of a study conducted across 27 Italian Forensic Institutes. We analyzed 1,238 cases of female homicide and, adopting the definition of femicide as the murder due to the failure to recognize women's right to self-determination, we identified 410 cases as femicides and 395 as non-femicides Current partners were identified as aggressors in a much larger proportion of femicide cases (241 femicides vs. 145 non-femicides; odds ratio (OR) of femicide 2.46, 95 % CI 1.85–3.27), such association being more pronounced for ex-partners (102 vs. 11; OR 11.56, 95 % CI 6.10–21.92). Sharp weapons showed a higher frequency in femicides (168 vs. 140; OR 1.26, 95 % CI 0.95–1.68). Femicides were more often associated with bodies found in vehicles (31 vs. 9; OR 3.50, 95 % CI 1.64–7.45) and outdoor (68 vs. 43; OR 1.62, 95 % CI 1.08–2.45).

There was an indication of femicides being more frequently associated with overkilling (87/323 vs. 71/324; OR 1.24, 95 % CI 0.88–1.76) and even more with lesions located in erogenous zones (94/316 vs. 70/325; OR 1.38, 95 % CI: 0.97–1.95). However, the strongest (though statistically imprecise) association emerged for overkilling in erogenous zones (12/398 vs. 6/389; OR 1.95, 95 % CI: 0.72–5.25). The number of lesions showed a nonlinear association with femicide likelihood.

These findings offer forensic indicators that could contribute in predicting and potentially prevent femicide occurrence in a Western population such as the Italian one.

1. Introduction

The data on violence against women around the world is tragically alarming, to the point that it is estimated that in 2023, a woman was intentionally killed every 10 min by a partner or family member: the phenomenon of femicide is a true global crisis, affecting women in every country and territory in the world. To date, it is believed that many cases of femicide go unreported due to a lack of information on motives, and as a result, the statistics on such cases represent only the tip of an iceberg of far greater proportions [1].

Sociological reflection is playing an increasingly significant role in analysing this phenomenon. Examining femicide requires analysing multiple historical, cultural, traditional, patriarchal, political, and individual factors. These influences are so pervasive that they constitute the origin of the phenomenon itself. The reflection emphasises the importance of understanding the historical and social dynamics that shape these contexts and reflect some social action and individual behaviour. Sociocultural, political, and social network variables are often overlooked or misunderstood aspects of reality that contribute to the perpetuation of violent actions and can be considered "grey areas" in social explanations [2].

In 1976, Diana Russell introduced the term "femicide" to the International Tribunal on Crimes Against Women, defining it as the killing of females because they are female [3]. The first to enact specific legislation on femicide were several countries in South America in the early 2000s, in an attempt to curb a particularly alarming scourge in that region [4]. Since the United Nations adopted Resolution 68/191 in 2013, calling on states to address gender-related killings of women and girls, several high-income countries have introduced femicide legislation. In Italy, on July 23, 2025, the Senate unanimously approved, in first reading, the bill introducing femicide as an autonomous crime in the Penal Code (Art. 577-bis). The new provision defines femicide as the killing of a woman "for reasons related to gender, stemming from hatred, discrimination, domination, possession, or the intent to suppress her freedom and self-determination," and establishes life imprisonment as the penalty [5].

The International scientific community, in the field of forensic pathology, has shown a growing interest in femicide in recent years. Cecchi *et al.* (2022) proposed a medico-legal definition of femicide as *"the murder due to the failure to recognise women's right to self-determination"*. This means that the victim is killed because she had responded negatively to a request from the killer or because she had different desires and beliefs from those of the attacker [6]. Notably, this conceptualization closely mirrors the legislative definition now adopted in Italy, as both emphasize the killing of women precisely because they have exercised, or attempted to exercise, their freedom and autonomy [5,6].

The severity and number of cases of femicide warrant a high level of attention from the scientific community to the point that numerous

studies have been published in the literature in recent years. However, previous studies on femicide [7–27] display substantial heterogeneity, which makes it difficult to integrate findings and draw shared conclusions. This variability is explained by several factors. First, the operational definition of femicide is not uniform: some authors adopt a broad sociological perspective including all gender-related killings of women [9,10,25,26], while others restrict the term to intimate partner homicide [7,14,17,19,21,24]. Second, some studies are based on medico-legal case series [12,13,15,20,22,23,27], while others rely on population-based epidemiological data [8,11,16,18] or on media reports and observatories [9,10]. Third, the forensic parameters investigated are not consistent across studies, ranging from injury patterns and overkilling [20,22,23], to weapon type [12,15,19], to contextual risk factors such as prior intimate partner violence [7,14,17,21,24]. In addition, cultural, legal, and socio-political contexts strongly influence the way femicides are defined, investigated, and classified in different countries.

In light of these issues, the present study aims to provide a systematic medico-legal analysis of femicide cases, integrating forensic pathology with an epidemiological perspective, in order to contribute to a more standardized framework for research and prevention.

2. Materials and methods

2.1. Data collection

Twenty-seven Italian Forensic Institutes, following the invitation by the Parma University Institute, agreed to contribute to the study. The *Italian Femicide Working Group of Forensic Pathologists* (IFWGoFP) has therefore been officially established. A standardised data collection form, inspired by Cecchi *et al.* [28], was given to each participant institute. Following data were requested for each case: motive of the murder; age of the victim; dynamics of death; means used; homicide/victim relationship; place of homicide; anatomical sites; type of wounds; number of wounds; toxicological findings and medico-legal notes.

Two forensic pathologists from each Institute compiled the form by examining all autopsy reports, photographic surveys, and court and tribunal documents acquired from each Institute's archive related to murders that occurred after the year 1950. Each institute reported cases where information was still available.

Data were anonymised by each institute, so that each case was converted into a number and then sent to the Institute of Parma and analysed by some of the authors.

We classified data collected into femicide and non-femicide female homicides, according to the definition provided by Cecchi *et al.* [6].

Ethics approval was not required because the study assessed forensic autopsies, with consent clearly not achievable, and all data were received and analysed in an anonymised version.

For the purposes of this study, we included only those cases that could be clearly classified as femicide or non-femicide, as outlined in Fig. 1. We excluded from the analysis cases with insufficient data or ambiguous classification to preserve internal consistency and analytical validity.

2.2. Data analysis

We investigated the association between case classification (femicide vs. non-femicide) and specific characteristics of the crime through logistic regression analysis computing odds ratio (OR) and its 95 % confidence interval (IC). The dependent variable was the classification as femicide or non-femicide, while independent variables included: the nature of the victim-aggressor relationship (namely partner, ex-partner, extramarital affair, relative, client, acquaintance, robber/kidnapper, or unknown relationship); the means used (e.g., sharp weapon, firearm, blunt force trauma, asphyxiation); the dynamics of death (distinguishing between single and multiple methods); the place of homicide.

All models were conditional on the case being a homicide, reflecting a case–case analysis estimating the likelihood that a homicide is classified as femicide (rather than non-femicide), based on the aforementioned variables.

All variables included in the models, along with their operational definitions and case-specific frequencies, are detailed in Table 1 and Table 2.

We conducted a specific analysis on the extent and anatomical distribution of physical violence and the presence of overkilling, defined as more than 10 injuries following the cut-off proposed by Kopacz *et al.* 2022 [29], and/or the co-occurrence of multiple types of means used (e.g., combination of blunt, sharp, and asphyxia trauma). We further explored overkilling in anatomically significant regions, namely the areas related to identity and expression of own self-determination (head, face, mouth) and the erogenous zones (breast area, pubic region, perineum, and buttocks).

We used a binary (femicide vs. non-femicide) logistic regression model to estimate the odds of each outcome category based on the total number of lesions. To account for potential non-linear relations, the continuous variable 'total number of lesions' was modelled using a restricted cubic spline function, in order to characterise its association with the OR of feminicide versus non-femicide homicide For all data analyses, we reported and interpreted the results based on an evaluation of the magnitude, direction, and precision of the effect estimates, rather than binary significance testing [30–32]. We performed all statistical analyses using Stata software (version 18.0, StataCorp LCC, College Station, TX, 2023).

3. Results

Characteristics of cases included in the study, divided by femicide and non-femicide, are reported in Table 1. Variables included in the models and their operational definitions are shown in Table 2.

The characteristics and risk factors associated with femicide are reported in Table 3.

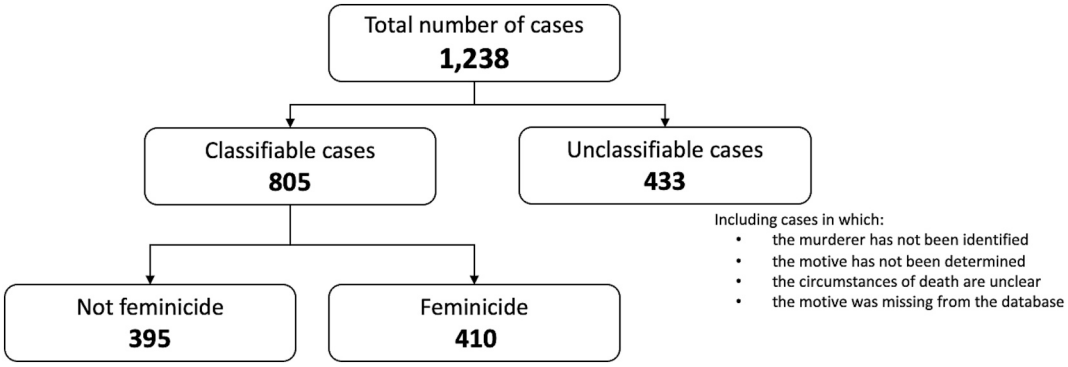

Fig. 1. Flow chart of the case classification process.

Table 1
Demographic and case-specific variables and their frequencies.

	Femicide	Non-femicide	Unclassifiable	Total
	N (%)	N (%)	N (%)	N (%)
Age				
Mean (SD)	57.59 (22.43)	38.98 (14.14)	43.88 (20.11)	46.65 (20.70)
0–15	6 (1.46)	13 (3.31)	13 (3.12)	32 (2.62)
16–30	115 (28.05)	50 (12.72)	117 (28.06)	282 (23.11)
31–45	179 (43.66)	52 (13.23)	104 (24.94)	335 (27.46)
46–60	80 (19.51)	80 (20.36)	83 (19.90)	243 (19.92)
60+	30 (7.32)	198 (50.38)	100 (23.98)	328 (26.89)
Relation victim-aggressor				
Partner	241 (58.78)	145 (36.71)	153 (35.66)	539 (43.68)
Ex-Partner	102 (24.88)	11 (2.78)	35 (8.16)	148 (11.99)
Extramarital affair	7 (1.71)	2 (0.51)	1 (0.23)	10 (0.81)
Relative	18 (4.39)	126 (31.90)	52 (12.12)	196 (15.88)
Client	9 (2.20)	2 (0.51)	15 (3.50)	26 (2.11)
Acquaintance	20 (4.88)	38 (9.62)	23 (5.36)	81 (6.56)
Robber/Kidnapper	0 (0.00)	22 (5.57)	0 (0.00)	22 (1.78)
Unknown relationship	13 (3.17)	49 (12.41)	150 (34.97)	212 (17.18)
Means used				
Sharp weapon	168 (41.18)	140 (35.62)	149 (35.14)	457 (37.28)
Firearm	110 (26.96)	99 (25.19)	123 (29.01)	332 (27.08)
Blunt object	44 (10.78)	64 (16.28)	62 (14.62)	170 (13.87)
Asphyxiation (manual method)	49 (12.01)	39 (9.92)	49 (11.56)	137 (11.17)
Asphyxiation (not manual method)	33 (8.09)	40 (10.18)	29 (6.60)	102 (8.32)
Vehicle (car-pedestrian collision)	2 (0.49)	3 (0.76)	2 (0.47)	7 (0.57)
Caustic substances	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Drugs/toxic substances	0 (0.00)	4 (1.02)	2 (0.47)	6 (0.49)
Thermal energy	2 (0.49)	4 (1.02)	9 (2.12)	15 (1.14)
Gas	0 (0.00)	0 (0.00)	0 (0.00)	1 (0.08)
Dynamics of death				
Sharp weapon	117 (28.82)	105 (26.65)	114 (26.89)	336 (27.45)
Firearm	103 (25.37)	96 (24.37)	117 (27.59)	316 (25.82)
Asphyxiation	45 (11.08)	48 (12.18)	56 (13.21)	149 (12.17)
Beating	46 (11.33)	60 (15.23)	54 (12.74)	160 (13.07)
Precipitation	3 (0.74)	5 (1.27)	3 (0.70)	11 (0.90)
Intoxication	0 (0.00)	4 (1.02)	2 (0.47)	6 (0.49)
Burns	1 (0.25)	3 (0.76)	8 (1.89)	12 (0.98)
Hanging	0 (0.00)	2 (0.51)	1 (0.24)	3 (0.25)
Run over	2 (0.49)	3 (0.76)	2 (0.47)	7 (0.57)
Thermal energy	1 (0.25)	1 (0.25)	1 (0.24)	3 (0.25)
Explosion	1 (0.25)	0 (0.00)	0 (0.00)	1 (0.08)
Sharp weapon + Beating	37 (9.11)	22 (5.58)	30 (7.08)	89 (7.27)
Sharp weapon + Asphyxiation	6 (1.48)	2 (0.51)	2 (0.47)	10 (0.82)
Sharp weapon + Burns	1 (0.25)	3 (0.76)	0 (0.00)	4 (0.33)
Firearm + Beating	6 (1.48)	2 (0.51)	5 (1.18)	13 (1.06)
Sharp weapon + Asphyxiation + Intoxication	0 (0.00)	0 (0.00)	1 (0.24)	1 (0.08)
Asphyxiation + Beating	28 (6.90)	25 (6.35)	20 (4.72)	73 (5.96)
Sharp weapon + Precipitation	1 (0.25)	1 (0.25)	0 (0.00)	2 (0.16)
Sharp weapon + Firearm	0 (0.00)	2 (0.51)	2 (0.47)	4 (0.33)
Sharp weapon + Asphyxiation + Beating	2 (0.49)	4 (1.02)	0 (0.00)	6 (0.49)
Firearm + Burns	0 (0.00)	0 (0.00)	1 (0.24)	1 (0.08)
Beating + Burns	1 (0.25)	1 (0.25)	2 (0.47)	4 (0.33)
Sharp weapon + Firearm + Beating	0 (0.00)	0 (0.00)	1 (0.24)	1 (0.08)
Asphyxiation + Intoxication	0 (0.00)	1 (0.25)	1 (0.24)	2 (0.16)
Beating + Precipitation	0 (0.00)	0 (0.00)	1 (0.24)	1 (0.08)
Asphyxiation + Burns	1 (0.25)	0 (0.00)	0 (0.00)	1 (0.08)
Firearm + Run over	1 (0.25)	1 (0.25)	0 (0.00)	1 (0.08)
Sharp weapon + Beating + Burns	0 (0.00)	1 (0.25)	0 (0.00)	1 (0.08)
Firearm + Asphyxiation	1 (0.25)	1 (0.25)	0 (0.00)	2 (0.16)
Sharp weapon + Firearm + Asphyxiation	1 (0.25)	0 (0.00)	0 (0.00)	1 (0.08)
Beating + Intoxication	1 (0.25)	0 (0.00)	0 (0.00)	1 (0.08)
Asphyxiation + Beating + Burns	1 (0.25)	0 (0.00)	0 (0.00)	1 (0.08)
Place of homicide				
Home	263 (67.96)	308 (82.35)	218 (69.21)	792 (73.61)
Workplace	12 (3.10)	7 (1.87)	3 (0.95)	23 (2.14)
Outdoor	68 (17.57)	43 (11.50)	58 (18.41)	167 (15.52)
Indoor – Other (not home, not workplace	13 (3.36)	7 (1.87)	13 (4.13)	31 (2.88)
Vehicle	31 (8.01)	9 (2.41)	23 (7.30)	63 (5.86)

Femicide cases were most frequently associated with intimate or past intimate relationships, as also shown in Fig. 2. Current partners were identified as aggressors in a large proportion of femicide cases (241 femicides vs. 145 non-femicides; OR of femicide 2.46, 95 % CI 1.85–3.27), and this association was particularly pronounced for ex-partners (102 vs. 11; OR 11.56, 95 % CI 6.10–21.92). Other intimate but non-primary relationships, such as extramarital affairs, also showed increased odds of femicide classification (7 vs. 2; OR 3.41, 95 % CI 0.70–16.53), although the estimate was very statistically imprecise since these cases occurred rarely in our sample. Client-perpetrated homicides (e.g., in the context of sex work) were rare overall, but more frequent among femicide cases (9 vs. 2; OR 4.41, 95 % CI 0.95–20.54).

Conversely, cases involving family members (excluding partners) were less commonly associated with femicide homicides (18 vs. 126; OR 0.10, 95 % CI 0.06–0.16). Similarly, femicides were less likely than non-femicides to involve perpetrators who were acquaintances (20 vs. 38; OR 0.48, 95 % CI 0.28–0.84) or had an unknown/unclear relationship with the victim (13 vs. 49; OR 0.23, 95 % CI 0.12–0.43).

Homicides committed by robbers, kidnappers, or organized crime organizations occurred only among non-femicide cases (21 vs. 0), therefore indicating their extremely unlikely occurrence with femicides.

Regarding the means used (Fig. 3), sharp weapons were the most frequently used in all killings, with a slightly higher frequency in femicide compared to non-femicide (168 vs. 140; OR 1.26, 95 % CI 0.95–1.68). Firearms were the second highest methods of killing but did not show specific association with femicide. Conversely, blunt object trauma was less commonly observed in femicides (44 vs. 64; OR 0.62, 95 % CI 0.41–0.94).

Asphyxial death resulting from methods that do not involve direct manual contact by the assailant (suffocation caused by the obstruction of

Table 2
Variables included in the models and their operational definitions.

Variable	Examples
Relation victim-aggressor	
Partner	husband; cohabiting partner; fiancé
Ex-Partner	ex-husband; ex-partner; separated spouse
Extramarital affair	lover; extramarital partner; ex-lover
Relative	father; son; brother; daughter; son-in-law; nephew; grandfather
Client	client; client of a sex worker
Acquaintance	neighbour; friend; co-worker; caregiver; stalker
Robber/Kidnapper	thief; robber; hitman
Unknown relationship	unknown man; unidentified; homeless person
Means used	
Sharp weapon	kitchen knife; blade; machete
Firearm	gun; pistol
Blunt object	hammer; bat; stick
Asphyxiation (manual method)	pillow; rope; plastic bag
Asphyxiation (not manual methods)	hands; feet
Vehicle (car-pedestrian collision)	car; truck; tractor
Caustic substances	acid; bleach
Drugs/toxic substances	sedatives; poison
Thermal energy	freezing; cold exposure; fire
Gas	carbon monoxide; gas leak
Dynamics of death	
Sharp weapon	knife wounds; slashing
Firearm	firearm injury
Asphyxiation	strangulation; suffocation; drowning
Beating	manual blunt trauma;
Precipitation	pushed from stairs or balcony
Intoxication	drug overdose; gas inhalation
Burns	fire-related injuries; thermal trauma
Hanging	hanging by rope or similar
Run over	intentional vehicle impact
Hypothermia	freezing; cold exposure
Explosion	body disintegration from blast
Place of homicide	
Home	victim/victim relatives/aggressor home; garage; private residence
Workplace	salon; office; workplace residence
Outdoor	park; river; forest; roadside
Indoor – Other (not home, not workplace	hotel; store; hospital; church; farmhouse; construction site
Vehicle	inside car; parked vehicle; trailer

the respiratory orifices using an object, such as a pillow, or through the method known as plastic bag suffocation, and ligature strangulation) was slightly more prominent in femicide cases (49 vs. 39; OR 1.24, 95 % CI 0.79–1.93), while manual methods (e.g., manual strangulation or manual suffocation) were less frequently observed compared with non-femicide cases (33 vs. 40; OR 0.78, 95 % CI 0.48–1.26).

However, some specific methods were too infrequent to allow for robust interpretation, yielding very statistically unstable risk estimates. In only five cases, the homicide involved the victim being run over by a vehicle (2 vs. 3; OR 0.64, 95 % CI 0.11–3.85), thermal energy (hypothermia or burning) was used again in only six instances across both groups (2 vs. 4; OR 0.48, 95 % CI 0.09–2.63), and CO intoxication was involved in only one femicide case. No cases involved killing by caustic substances.

The analysis of the dynamics of death revealed similar patterns. Fig. 4 shows single-method attacks: sharp weapon assaults, the most frequently detected dynamic in both categories, was slightly more common in femicides (117 vs. 105; OR 1.21, 95 % CI 0.88–1.68), as were firearms (103 vs. 96; OR 1.14, 95 % CI 0.81–1.59) but asphyxiation (45 vs. 48; OR 0.95, 95 % CI 0.61–1.47), though in all cases the odds ratio estimates were statistically imprecise. When considering the combined dynamics of death, presented in Fig. 5, femicide cases more frequently involved multiple modes of assault. Specifically, the combination of sharp weapon and beating (37 vs. 22; OR 1.68, 95 % CI 0.97–2.91), sharp weapon and asphyxiation (6 vs. 2; OR 2.92, 95 % CI 0.59–14.55),

Table 3
Characteristics of femicide and non-femicide killings by victim-aggressor relationship, method of killing and attack, and location of crime and/or body recovery.

	Femicide (yes/no)	Non-femicide (yes/no)	Odds ratio	95 % confidence interval
Relation victim-aggressor				
Partner	241/169	145/250	2.46	1.85–3.27
Ex-Partner	102/308	11/384	11.56	6.10–21.92
Extramarital affair	7/403	2/393	3.41	0.70–16.53
Relative	18/392	126/269	0.10	0.06–0.16
Client	9/401	2/393	4.41	0.95–20.54
Acquaintance	20/390	38/357	0.48	0.28–0.84
Robber/Kidnapper	0/410	21/374	–	–
Unknown/Unclear relationship	13/397	49/346	0.23	0.12–0.43
Means used				
Sharp weapon	168/242	140/255	1.26	0.95–1.68
Firearm	110/300	99/296	1.1	0.8–1.5
Blunt object	44/366	64/331	0.62	0.41–0.94
Asphyxiation (manual method)	49/361	39/356	1.24	0.79–1.93
Asphyxiation (not manual method)	33/377	40/355	0.78	0.48–1.26
Vehicle (car-pedestrian collision)	2/408	3/392	0.64	0.11–3.85
Caustic substances	0/410	0/395	–	–
Drugs/toxic substances	0/410	4/391	–	–
Thermal energy	2/408	4/391	0.48	0.09–2.63
Gas	1/409	0/395	–	–
Dynamics of death				
Sharp weapon	117/206	105/224	1.21	0.88 – 1.68
Firearm	103/220	96/233	1.14	0.81 – 1.59
Asphyxiation	45/278	48/281	0.95	0.61 – 1.47
Beating	46/277	60/269	0.74	0.49 – 1.13
Precipitation	3/320	5/324	0.61	0.14 – 2.56
Intoxication	0/323	4/325	–	–
Burns	1/322	3/326	0.34	0.03 – 3.26
Hanging	0/323	2/327	–	–
Run over	2/321	3/326	0.68	0.11 – 4.08
Thermal energy	1/322	1/328	1.02	0.06 – 16.35
Explosion	1/322	0/329	–	–
Sharp weapon + Beating	37/373	22/373	1.68	0.97–2.91
Sharp weapon + Asphyxiation	6/404	2/393	2.92	0.59–14.55
Sharp weapon + Burns	1/409	3/392	0.32	0.03–3.08
Firearm + Beating	6/404	2/393	2.92	0.59–14.55
Sharp + Asphyxiation + Intoxication	0/410	0/395	–	–
Asphyxiation + Beating	28/382	25/370	1.08	0.62–1.9
Sharp weapon + Precipitation	1/409	1/394	0.96	0.06–15.45
Sharp weapon + Firearm	0/410	2/393	–	–
Sharp weapon + Asphyxiation + Beating	2/408	4/391	0.48	0.09-
Firearm + Burns	0/410	0/395	–	–
Beating + Burns	1/409	1/394	0.96	0.06–15.45
Sharp weapon + Firearm + Beating	0/410	0/395	–	–
Asphyxiation + Intoxication	0/410	1/394	–	–
Beating + Precipitation	0/410	0/395	–	–
Asphyxiation + Burns	1/409	0/395	–	–
Firearm + Run over	1/409	0/395	–	–
Sharp weapon + Beating + Burns	0/410	1/394	–	–
Firearm + Asphyxiation	1/409	1/394	0.96	0.06–15.45
Sharp weapon + Firearm + Asphyxiation	1/409	0/395	–	–
Beating + Intoxication	1/409	0/395	–	–
Asphyxiation + Beating + Burns	0/410	1/394	–	–

(continued on next page)

Table 3 (*continued*)

	Femicide (yes/no)	Non-femicide (yes/no)	Odds ratio	95 % confidence interval
Place of homicide				
Home	263/146	307/86	0.50	0.37–0.69
Workplace	12/397	7/386	1.67	0.65–4.28
Outdoor	68/341	43/350	1.62	1.08–2.45
Other (Indoor)	13/396	7/386	1.81	0.71–4.59
Vehicle	31/378	9/384	3.50	1.64–7.45

and firearm and beating (6 vs. 2; OR 2.92, 95 % CI 0.59–14.55) appeared more commonly among femicides, though again statistically unstable.

The place of homicide is presented in Fig. 6. Femicides occurred considerably less frequently in domestic settings compared with non-femicides (263 vs. 307; OR 0.50, 95 % CI 0.37–0.69), while they were more often associated with bodies being found in vehicles (31 vs. 9; OR 3.50, 95 % CI 1.64–7.45) and in outdoor environments (68 vs. 43; OR 1.62, 95 % CI 1.08–2.45).

Fig. 7 presents sub-analyses examining overkilling and injury patterns in specific anatomical regions, namely in identity and self-determination expression-related sites (head, face, mouth) and in erogenous zones (breast area, pubic region, perineum, and buttocks). Cases classified as femicide were slightly more frequently associated with overkilling (87/323 vs. 71/324) with an OR of 1.24 (95 % CI 0.88–1.76). The presence of at least one lesion in identity and self-determination expression-related sites showed almost no difference between groups (268/142 femicide vs. 254/141 non-femicide; OR 1.04, 95 % CI 0.78–1.39). When focusing specifically on overkilling in identity and self-determination expression-related sites, the association with

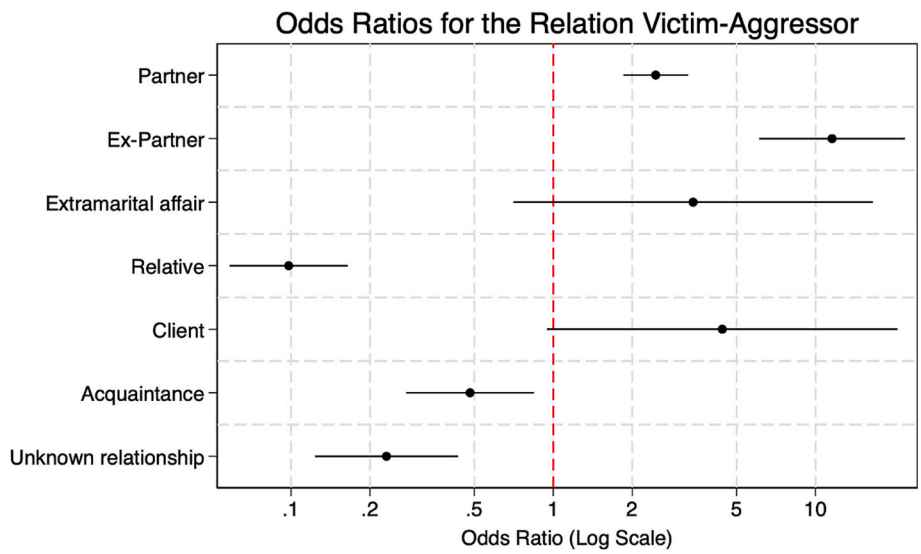

Fig. 2. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between victim-aggressor relationship and risk for a homicide being classified as femicide vs. non-femicide (reference).

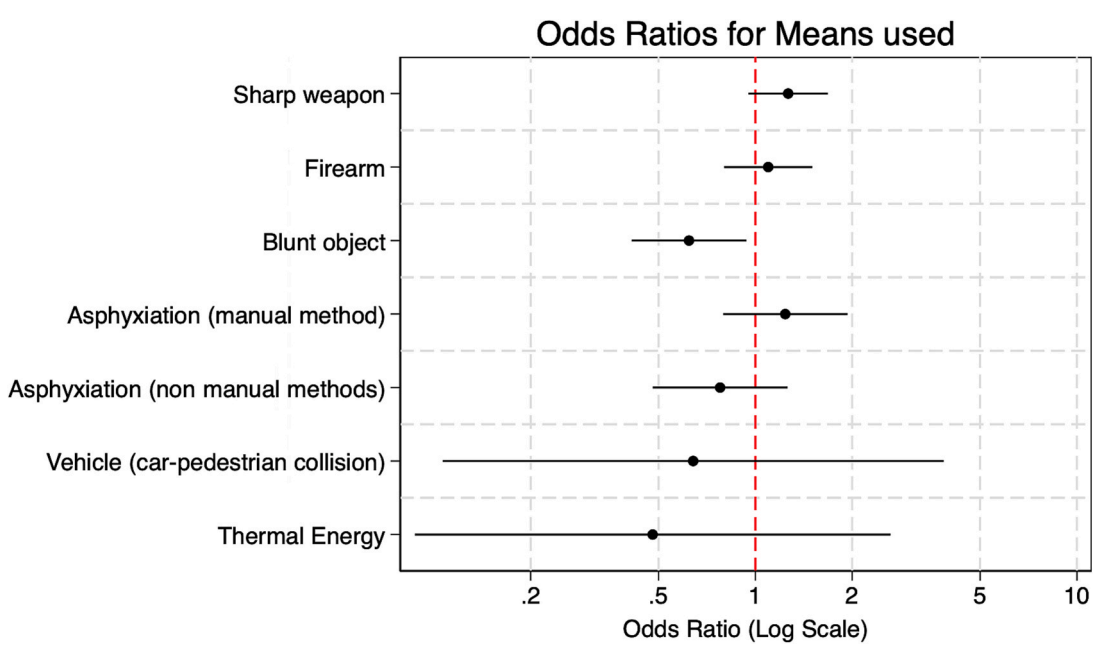

Fig. 3. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between the means used and risk for a homicide being classified as femicide vs. non-femicide (reference).

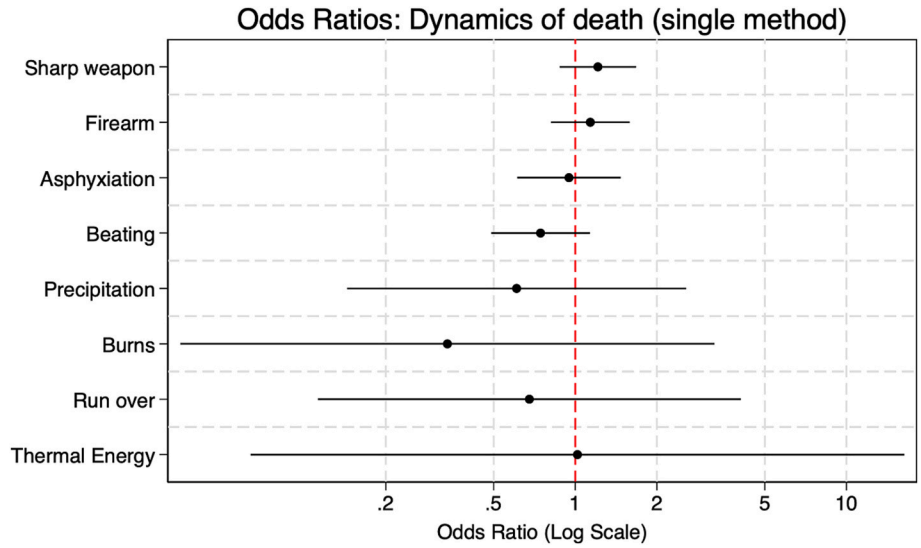

Fig. 4. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between dynamics of death (single method) and risk for a homicide being classified as femicide vs. non-femicide (reference).

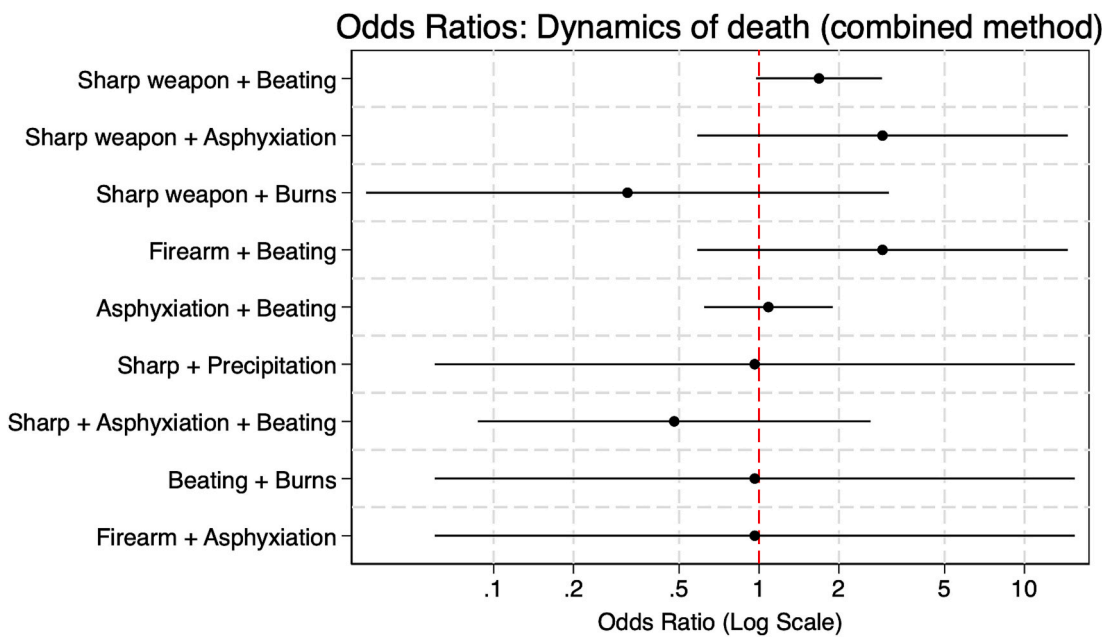

Fig. 5. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between dynamics of death (combined method) and risk for a homicide being classified as femicide vs. non-femicide (reference).

femicide showed a modestly increased odds (71/339 vs. 57/338; OR 1.26, 95 % CI 0.86–1.84). Lesions located in erogenous zones appeared more frequently in femicide cases (94/316 vs. 70/325; OR 1.38, 95 % CI: 0.97–1.95), and the strongest association, albeit statistically imprecise, emerged for overkilling in erogenous zones (12/398 vs. 6/389; OR 1.95, 95 % CI: 0.72–5.25).

The non-linear pattern of relation between the number of lesions and the odds ratio for a homicide being classified as femicide, as compared to non-femicide, is reported in Fig. 8. The risk of a homicide being classified as femicide rose monotonically with the number of lesions. A steep increase was observed up to around 20 lesions (OR 1.48, 95 % CI: 0.95–2.31), after which the risk continued to rise more gradually. Over 60 lesions, the association further increased, though the estimate became less statistically precise due to the lower sample size (OR 1.84, 95 % CI: 0.99–3.42), and such trend was confirmed above 100 lesions (OR 2.19, 95 % CI: 0.71–6.77).

4. Discussion

Women's right to self-determination is undermined and irreparably compromised by the occurrence of femicides. Recognising the predictive elements and warning signs represents a sound preventive strategy for such heinous crime [11,12], and allows a medico-legal prognosis in victims of gender violence.

The purpose of this study is to identify a broad-based methodology for studying the phenomenon of femicide, through the collection of data from all over Italy, to arrive at mutually comparable results and a definition applicable in any country in the world, regardless of national specificities.

The motives behind these killings have been thoroughly examined in

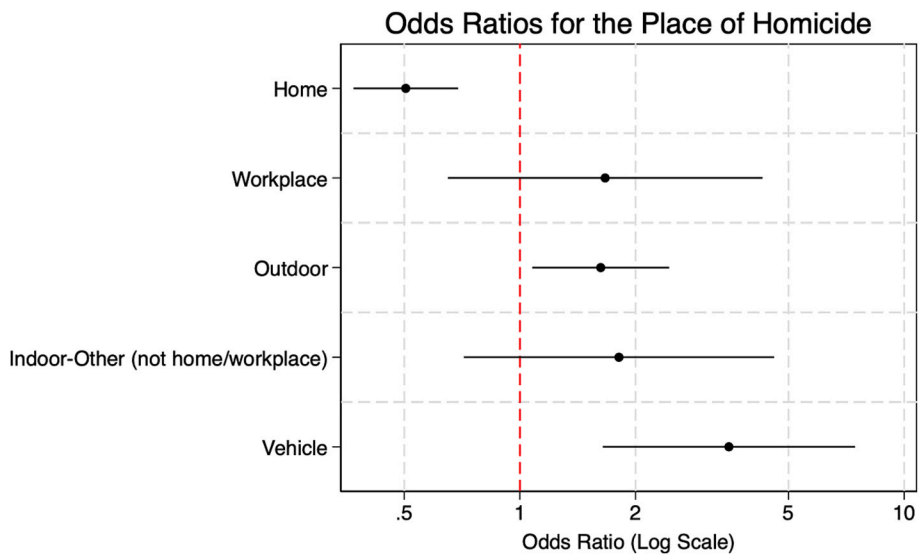

Fig. 6. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between the place of homicide and risk for a homicide being classified as femicide vs. non-femicide (reference).

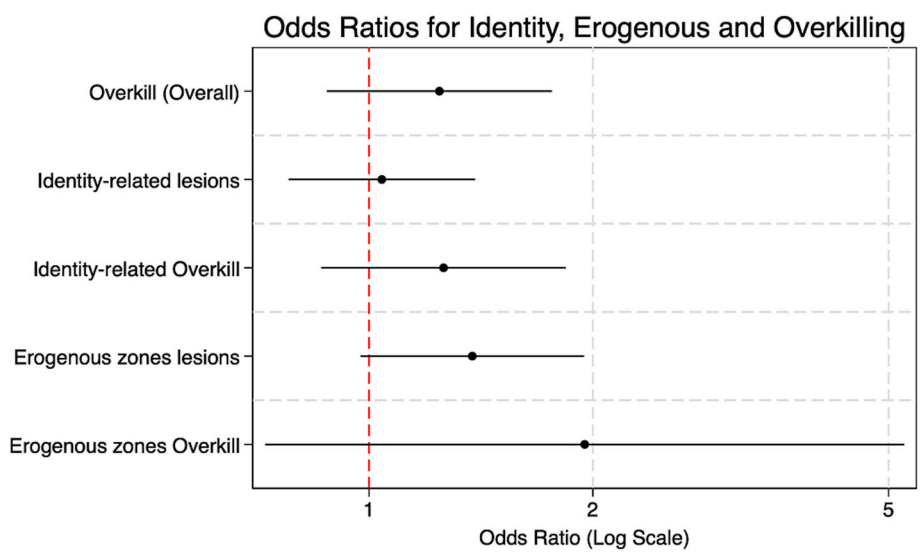

Fig. 7. Odds ratio (OR, black dots) and 95 % confidence intervals (horizontal black lines) for the association between overkill (>10 lesions), identity-related lesions, and lesions in erogenous zones and risk for a homicide being classified as femicide vs. non-femicide (reference).

a separate publication [33]. In that previous analysis, we found that most femicides were driven by motives such as *separation/divorce* and *jealousy/rejection*, whereas non-femicide female homicides were more commonly associated with the perpetrator's psychopathology and/or substance addiction.

The epidemiological interpretation of our data allows a broader understanding of prevalence, risk distribution, and population-level trends, thereby informing prevention strategies. This dual approach, integrating forensic pathology with epidemiology, is essential for addressing femicide as both a matter of individual criminal investigation and a public health concern. Such an interdisciplinary perspective reinforces the central role of legal medicine in generating robust evidence to guide preventive and policy interventions.

Our results emphasize the urgent need for targeted preventive strategies on victims of gender violence that address the underlying relational and emotional factors driving femicide, alongside tailored forensic and investigative approaches to accurately identify and classify these cases. Recognizing femicide as a distinct phenomenon is essential for informing policy, enhancing victim protection, and advancing justice for women subjected to lethal violence.

4.1. *Intimate relationships as a central risk context*

In our sample, femicide cases were most strongly associated with current or past intimate relationships. The involvement of current partners, ex-partners, and extramarital affairs was consistently linked to higher odds of femicide, indicating that both ongoing and terminated sentimental ties represent central contexts for femicide in Italy. Although client-perpetrated killings were rare, they too showed increased odds for femicide. In contrast, non-femicide female homicides were more frequently committed by other family members, acquaintances, or unknown perpetrators, reflecting a markedly different relational profile. Notably, these non-femicide cases were often associated with the perpetrator's evident psychopathology or substance use disorders, as well as so-called "compassionate homicides," such as elderly husbands killing severely ill wives.

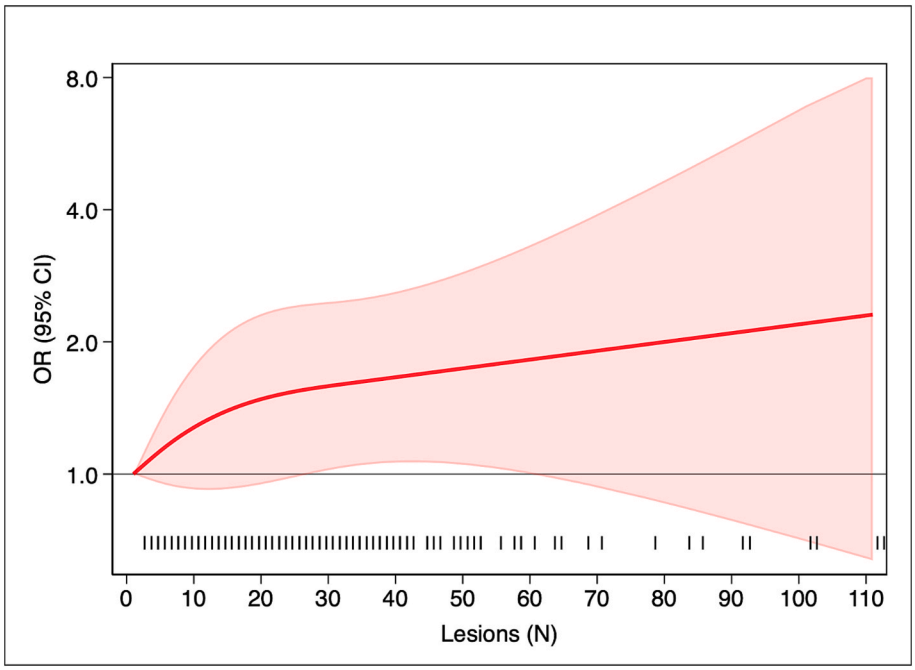

Fig. 8. Non-linear relation between the number of lesions and the odds of a homicide being classified as a femicide. The red line represents the odds ratio (OR), the shaded area indicates the 95% confidence interval (CI), and the black ticks show the distribution of the observed data points for the number of lesions. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

In the present study, we adopted the forensic definition of femicide proposed by Cecchi *et al.* (2022), which aims to be inclusive, encompassing even those cases in which the victim-perpetrator relationship does not fall within the scope of an affective or intimate relationship [6]. Indeed, cases of honour killings and religion-related murders clearly violate woman's right to self-determination, despite not being linked to a sentimental relationship [13,34–38].

Overall, our findings underscore the predominant role of the affective–emotional dimension in femicides within the Italian cultural context. Even in cases involving sex workers, femicides committed by clients appear to reflect a denial of the victim's right to self-determination, reinforcing the centrality of control, emotion, and relationship dynamics in these acts of violence.

These emotional dynamics are strongly supported in the Italian literature [21,39–42]. Zara *et al.* (2019) observed that the majority of femicides involve current or former intimate partners, often following contentious breakups, while non–intimate femicides are more frequently driven by predatory motives [39]. Similarly, Sorrentino *et al.* (2020) identified jealousy, inability to accept the end of a relationship, and conflict as predominant motives among adult femicide victims [21].

4.2. Means used

Sharp weapons were the most commonly used means of killing across all cases of female homicide, followed by firearms – both of which were slightly more associated with femicide. In contrast, blunt object trauma was more frequent in non-femicide cases, suggesting that these homicides may more often involve opportunistic, reactive, or less premeditated forms of violence.

Asphyxial deaths caused by non-manual methods—such as obstruction of the respiratory orifices using an object (e.g., a pillow, a ligature or a plastic bag)—were slightly more prevalent in femicides, whereas manual asphyxiation methods (e.g., manual strangulation or manual suffocation) did not show a clear association with either category. Notably, certain combinations of violent methods – such as sharp force trauma with beating, sharp force trauma with asphyxiation, and firearm use combined with beating – were associated with femicide.

These findings suggest that femicide cases may involve a greater degree of physicality and emotional intensity, often manifesting in prolonged or more complex forms of violence which reflect the perpetrator's intent to punish, control, or annihilate the woman's agency. The pattern points to a tendency toward more violent and multifaceted assaults in femicides, possibly reflecting heightened emotional involvement or intent to dominate and exert control over the victim.

Cecchi *et al.* (2023) and Zara *et al.* (2019) highlight the use of sharp weapons and asphyxiation in femicides, which are often associated with intimate partner violence and situations where the victim's autonomy is not recognized [6,39]. Biehler-Gomez *et al.* (2023) further emphasize the role of sharp force injuries and asphyxia in femicides, noting that these methods may be influenced by the victim's age and the perpetrator's intent [43].

4.3. Place of homicide

Femicide victims in our sample were more frequently murdered or found in vehicles or outdoor locations, compared to non-femicide cases. This finding may reflect both the dynamics of mobility in intimate or transactional relationships – such as encounters with current or former partners, or with clients in the case of sex workers – as well as an attempt by the perpetrator to isolate the victim or dispose of the body in less visible areas. These spatial patterns could also indicate premeditation or efforts to avoid detection, especially when the crime scene is removed from the victim's home.

This observation aligns with findings from Cecchi *et al.* (2022), who reported that while many intimate partner femicides in Italy occur in domestic settings, a subset—particularly those involving sex workers or extramarital relationships—are more likely to occur in public or semi-public locations such as vehicles or outdoor areas [28].

4.4. Injury location and overkilling patterns

Overkilling, defined according to Kovacs *et al.* (2022) [29] as the presence of more than 10 lesions or multiple types of injuries, was observed more frequently in femicide cases. While lesions to identity-

related areas occurred at similar rates across both femicide and non-femicide groups, overkilling in these regions was modestly more prevalent among femicides. Lesions in erogenous zones were more common in femicides, with the strongest association found for overkilling in these areas. These findings suggest a deliberate intent by the perpetrator in femicide cases to erase the victim's identity, self-determination, and sexual expression, as well as to silence her voice and autonomy.

These studies support the hypothesis that femicides involve a greater degree of physicality and emotional intensity, often manifesting in prolonged or more complex forms of violence [6,26]. The deliberate targeting of identity-related and erogenous zones, as observed in our findings, aligns with the intentional and symbolic nature of overkilling in femicides.

4.5. Dose-response between lesions and femicide odds

The overall trend observed between lesion count and the risk of femicide suggests a dose–response relationship, whereby an increasing number of lesions correlates with higher odds of the homicide being classified as femicide.

This dose–response pattern aligns with forensic findings that femicides often involve heightened levels of violence, manifesting in multiple and severe injuries. Previous research indicates that a greater number of lesions may reflect the perpetrator's intense emotional state, prolonged physical aggression, or deliberate intent to dominate and annihilate the victim's autonomy [6,29].

4.6. Strengths and limitations

A key strength of this work lies in its *trans*-disciplinary approach, which has produced two fundamental outcomes. First, the adoption of a shared case detection methodology, grounded in a unified definition of femicide [6] and harmonized indicators, facilitates the creation of robust, comparable datasets at national and European levels. Second, the integration of qualitative research enriches our understanding of femicide by situating it within specific social and cultural frameworks. Drawing on classical studies, such as those by Russell, this qualitative dimension helps interpret femicide not only in terms of causes of death, but also as a phenomenon embedded in broader power dynamics and societal structures.

However, this study has some limitations. Its retrospective design may introduce potential biases, and the limited sample size for rarer risk factors reduces the stability and precision of some risk estimates. Moreover, postmortem radiological investigations, which are increasingly recognized as valuable complementary tools in forensic practice, were not included in this analysis. In particular, postmortem CT and postmortem CT angiography, especially relevant in cases involving vascular lesions, could have provided additional insights by allowing a more precise visualization of vascular injuries, their distribution, and possible bleeding patterns [44–50]. Despite these constraints, our findings offer novel medico-legal perspectives and emphasize the importance of integrating epidemiological approaches into forensic investigations of femicide.

5. Conclusions

This study highlights the distinct characteristics that differentiate femicides from other female homicides in the Italian context. Femicides are predominantly committed by current or former intimate partners and are characterized by complex, multifaceted, and highly physical violence. The frequent use of sharp weapons and asphyxial methods, often in combination with other forms of assault, reflects a heightened emotional intensity and a deliberate intent to control or annihilate the victim's autonomy. The presence of overkilling, particularly targeting identity- and erogenous-related areas, further underscores the perpetrator's aim to erase the victim's self-determination and sexual identity. Moreover, the observed dose–response relationship between lesion count and femicide risk points to the extreme nature of violence involved in these crimes. The tendency for femicides to occur outside the domestic setting, such as in vehicles or outdoor locations, suggests situational and relational dynamics unique to this form of gender-based violence.

Combining quantitative and qualitative methodologies within a *trans*-disciplinary framework can yield effective interventions to prevent and counteract femicide occurrence. Continued collaboration across disciplines and countries is essential to deepen our knowledge and enhance efforts to eradicate this ubiquitous form of violence.

Author contribution

All the authors contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript.

Ethics approval

Not applicable.

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The authors did not receive support from any organization for the submitted work.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All relevant data are within the paper.

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