



UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Università degli Studi di Padova

Padua Research Archive - Institutional Repository

Criminological and Medico-legal Aspects in Homicidal and Suicidal Sharp Force Fatalities

Original Citation:

Availability:

This version is available at: 11577/3338016 since: 2021-08-31T13:05:56Z

Publisher:

Blackwell Publishing Inc.

Published version:

DOI: 10.1111/1556-4029.14285

Terms of use:

Open Access

This article is made available under terms and conditions applicable to Open Access Guidelines, as described at <http://www.unipd.it/download/file/fid/55401> (Italian only)

(Article begins on next page)



Criminological and Medico-legal Aspects in Homicidal and Suicidal Sharp Force Fatalities

Journal:	<i>Journal of Forensic Sciences</i>
Manuscript ID	JOFS-19-600.R2
Manuscript Type:	Paper
Keywords:	Homicide, Suicide, Sharp force injuries, forensic pathology, criminological analysis, complex suicide

SCHOLARONE™
Manuscripts

Criminological and Medico-legal Aspects in Homicidal and Suicidal Sharp Force Fatalities

ABSTRACT

The interpretation of sharp force fatality dynamics may be difficult in some cases, but a contribution to analysis of the phenomenon may be provided by case studies. **Therefore, the purpose of our study is focused on identifying, in observed sharp force fatalities, reliable parameters that can differentiate a homicidal and suicidal manner of death, with particular reference to criminological parameters.**

~~The present study aims at analyzing the characteristics of homicides and suicides by sharp force injuries in Padua and Venice from 1997 to 2019, with a view to differential diagnoses.~~ Data derived from **sharp force fatality cases in Padua and Venice from 1997 to 2019**, anonymized and collected in Excel, included personal, circumstantial, clinical, and psychopathological–criminological data, as well as crime scene investigation, necroscopic, and toxicological data.

Statistical analyses were performed using chi-square and Wilcoxon rank-sum tests. Possible predictors of homicide were analyzed by logistic regression. Six parameters (blood stains distant from the body, clothing lacerations, hesitation/defense wounds, number of injuries, and potential motives) were significantly different in the two groups ($p < 0.05$). An independent statistical association between potential motives explaining the crime ($p < 0.001$; OR 27.533) and homicide on multiple logistic regression analysis was highlighted. The absence of clothing lacerations was inversely related to homicide ($p = 0.002$, OR 0.092). To the best of our knowledge, this is one of very few Italian studies concerning the differential diagnosis between homicidal and suicidal sharp force fatalities. The dynamics of the event is established in most cases by the integrated evaluation of data from crime scene investigation and the autopsy. Nevertheless, in an atypical scenario, a psychopathological–criminological analysis may provide essential elements, and particular attention should be given to the identification of potential explanatory motives.

KEYWORDS: homicide, suicide, sharp force injuries, forensic pathology, criminological analysis, complex suicide

1
2
3 In 2015, an estimated 470,000 people worldwide were victims of homicide, with a global rate of 6.4
4 per 100,000 and the highest rates observed in males aged 15–29 (1). Globally, males commit almost
5
6
7
8 95% of homicides (2).

9
10 Italy's homicide rate is quite low compared to the European Union (0.59 per 100,000 in 2017); the
11
12 highest rate, after direct standardization, was observed for male subjects aged 25–34 and female
13
14 subjects over 64, followed by middle-aged women, with a total of 357 homicides in 2017 (3,4). In
15
16 particular, since the 1990s, a descending trend in the number of homicides was observed, mostly in
17
18 relation to male victims (the ratio of male homicides vs. female homicides dropped from 5:1 to 2:1).
19
20
21 Foreigners were the victims of homicide in 19.6% of cases (3).

22
23
24 Deaths due to homicide are largely exceeded by the number of suicides worldwide. According to the
25
26 World Health Organization, about 800,000 people commit suicide every year (5), with a global rate
27
28 of 10.6 per 100,000 (6).

29
30 In Italy, the number of suicides is 10 times greater than the number of homicides, with about 4000
31
32 people committing suicide every year, and almost 80% of them are males. The highest rate observed
33
34 after direct standardization was for male subjects aged 45–54 (7).

35
36
37 Sharp force fatalities represent the main cause of homicide in countries with strict firearm legislation
38
39 (8,9). An analysis of 417 verdicts in female homicide cases in Italy demonstrated that 40.2%, 18%,
40
41 15.5%, 12.8%, 9%, and 4.5% of these crimes were committed by means of, respectively, sharp
42
43 objects, strangulation, blunt trauma, firearms, blunt forces by fist and kick, and other causes (10).

44
45
46 The majority of homicides are committed by males, and the motive is frequently an interpersonal
47
48 conflict between the murderer and the victim, particularly when the victims are female (3,11–14).

49
50
51 “Hard” methods of suicide, such as sharp force self-destruction, are mainly used by men who
52
53 frequently have a psychiatric history (15,16), although the lethality of sharp forces is quite low in
54
55 comparison to other methods (17).

56
57
58 Sharp force violence is, nowadays, an uncommon method of suicide, constituting only 2–3% of all
59
60 self-inflicted deaths with a frequency almost equal to stabbing and cutting injuries (respectively, 40%

1
2
3 and 37%, with both present in around 25% of cases) (8,16,18–23). In Italy, in the period 2000–2014,
4
5 the use of a cutting weapon represented 2.1% (SD 0.32%) of self-inflicted deaths in males and 1.8%
6
7 (SD 0.47%) of self-inflicted deaths in females (7). Sharp force fatalities are, hence, a mainly
8
9 homicidal event, with a homicide to suicide ratio estimated to be around 6:1 to 5:2 (16).

10
11
12 In forensic practice, the differentiation between suicidal and homicidal sharp force violence is often
13
14 achieved by the integrated evaluation of data derived from a crime scene investigation as well as from
15
16 well-established necroscopic signs described in the literature (11). Nevertheless, some cases may
17
18 present unusual findings (23–25) with a difficult interpretation of the dynamics.

19
20
21 In such circumstances, a psychopathological–criminological analysis may provide essential elements.
22
23 In particular, from the psychopathological point of view, we hypothesized that a diagnosable
24
25 psychopathological disorder assessed by means of clinical data may indicate the identification of a
26
27 suicide and the possible exclusion of a homicide; this is based on the fact that the majority of the
28
29 subjects committing suicide had a psychiatric disorder (16). From the criminological point of view,
30
31 we hypothesized that the characteristics of the deceased are different in suicide and homicide events,
32
33 and in addition, there is the presence of indicators of potential motives. A general victimological role
34
35 may be suggested by the presence of features of the victim that may interfere with an appropriate
36
37 response to an assault; potential motives may be related to a specific context of the murder (e.g.,
38
39 homicide committed by a family member) (3). In particular, the knowledge one can glean of the most
40
41 frequent circumstances of murder linked to a specific form of homicide (e.g., domestic or criminal
42
43 homicide), and of the most common motives, may represent a useful additional tool in terms of
44
45 differential diagnosis.

46
47
48 The aims of this study were to (1) investigate the general characteristics of homicidal and suicidal
49
50 sharp force violence in Padua and Venice in the period 1997–2019, (2) find reliable necroscopic and
51
52 criminological features useful for a differential diagnosis between murder and suicide, and
53
54 (3) compare the results with national and international studies.
55
56
57
58
59
60

Materials and Methods

In this case-control study, we reviewed autopsy reports and alleged documentation from closed judicial proceedings involving sharp force fatalities observed at the Institute of Legal Medicine of the University of Padua and at the Department of Legal Medicine in the Health Unit of Venice in the period 1997–2019. The inclusion criteria were as follows:

- A homicidal or suicidal manner of death as established by the forensic pathologist.
- The availability of circumstantial data.
- The availability of iconographic material.
- The availability of data from the crime scene investigation, external examinations, and autopsy.
- The identification and characterization by the forensic pathologist of sharp force injuries that included either stab wounds (depth exceeds length) or incised wounds (cuts whose length exceeds depth).

Autopsy reports and iconographic material were reviewed by two forensic pathologists after an anonymization process was performed. The following parameters were recorded and are reported in Table 1: 1) personal data; 2) circumstantial data and event planning; 3) data from the crime scene investigation; 4) necroscopic and toxicological data; 5) clinical data; and 6) criminological data, where available. Criminological data included potential motives explaining the crime derived from circumstantial and investigative data as well as the presence of victimological aspects regarding the deceased. Potential motives explaining a crime and victimological aspects, even if suggestive of a specific dynamic, may be found for other reasons in atypical scenarios or cases. Potential motives were classified as being related to the presence of a **defined** psychiatric disorder in someone with a close relationship with the deceased (**immediate family, partner, ex-partner, close friend**), money (**inheritance matters, evidence of robbery**), drugs (**history of drug dealing**), jealousy/betrayal, conflictual/chaotic family background (**previous domestic violence, frequent quarrels with law enforcement alerted**), recent separation/divorce, trivial reasons, and unknown. A victimological role

1
2
3 was suggested by the presence of one of the following features: age (subjects younger than 10 or
4 older than 65), gender (female), state of intoxication, inability to defend oneself due to weakness/frail
5 constitution, or social marginality.
6
7
8

9
10 For a topographical assessment of injuries, we implemented the human model presented by Vassalini
11 et al. (8) (Fig. 1). If the review of the cases revealed conflicting interpretations of the available data,
12 a third evaluation was carried out by the senior author. Descriptive analyses were conducted in Excel,
13 separately for homicides and suicides. Homicide cases were then compared to suicide cases (controls)
14 according to variables related to the crime scene investigation and to necroscopic and criminological
15 data, where significance was determined by chi-square (Fisher's exact test) and Wilcoxon rank-sum
16 tests. Finally, to prevent confounding effects, multiple logistic regression analysis was performed.
17
18
19
20
21
22
23
24
25

26 27 **Results**

28
29 Fifty-one cases were included in this study, which covered the period 1997–2019. Gender, nationality,
30 and mean age of the deceased are provided in Table 2. The parameters of marital status, parenthood,
31 education, occupation, and toxicological analysis were not considered any further due to
32 unavailability of the data in most cases.
33
34
35
36
37

38 *Homicide*

39
40 Thirty-one (60.8% of the sample) homicide cases were analyzed, where a higher proportion of the
41 victims (18 out of 31 cases, or 58.1%) were male subjects aged 25–45. Homicides most frequently
42 occurred between 6.00 PM and 6.00 AM (19 cases, 61.2%). More than half of the cases occurred on a
43 weekend day (seven cases occurred on a Friday and nine cases on a Sunday), and the murders took
44 place at the victim's house in 51.6% of the cases. The weapon was found in 25 cases (83.3%) and
45 was recovered near the body of the victim in 16 cases (53.3%); in only one case was the weapon
46 found still inside the body (3.3%). The kitchen knife was the most frequently used sharp weapon (24
47 out of 30, or 80%). In 14 cases (47%), blood traces were found far from the body, and the victim
48 presented with blood on the palms of the hands in 19 cases (63.3%).
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 Clothing lacerations were present in 22 cases (70.96%). The median and interquartile range (in
4 parentheses) of the total number of injuries and defensive wounds were, respectively, 7 (2.5-15) and
5
6
7 1 (0-3). The distribution of injuries is shown in Fig. 2. No hesitation marks were described in any of
8
9
10 the cases. The victims suffered from physical diseases in three cases and from psychiatric disease in
11
12 two cases (depression and borderline personality disorder).

13
14 With regard to the relationship between the perpetrator and the victim, it was found that the
15
16 perpetrator of the crime was a member of the same family in the majority of the cases (17 cases,
17
18 54.8%). Potential motives explaining the fatal event that involved responsibilities of a third party
19
20 were present in 28 cases (90.3%); the most frequent motive was a psychopathological one (10 cases,
21
22 38.5%), followed by jealousy (six cases, 23.1%). Characteristics of the deceased that suggested a
23
24 victimological role were present in 18 cases (58.06%).

25 26 27 28 *Suicide*

29
30 Twenty cases of suicide (39.2% of the sample) were analyzed, and male subjects (17) aged 25–44
31
32 were most frequently affected (10 out of 20 cases, 50%). Suicides occurred most often between
33
34 midnight and 6 AM (eight cases, 40%) or between noon and 6 PM (eight cases, 40%). Sixty percent of
35
36 the suicides occurred during a weekend, and 10% occurred on a Monday morning. Twelve suicides
37
38 (60%) occurred in the victim's house. A written note explaining the reasons for suicide was found in
39
40 10 cases (50%). The weapon was found in all cases, including near or inside the body in 17 cases
41
42 (85% of the total). A kitchen knife was the most frequently used weapon (14 out of 20 cases, 70%).
43
44 In two cases (10%), blood traces were found far from the body. In 14 cases, there was blood on the
45
46 palms of the victim's hands (70%); clothing damage was present in four cases (20%).

47
48 The presence and localization of hesitation marks (10 of 20 cases, 50%) are reported in Fig. 3. Defense
49
50 wounds were present in one case. The average total lesions, excluding hesitation wounds, was 5.15;
51
52 median values (and interquartile range) of the total number of injuries was 3 (1-5.25). In seven cases,
53
54 a single lesion was described. The distribution of the lesions is described in Fig. 4. The death was
55
56 caused by sharp force injuries in 18 of the 20 cases (90%); in two cases, the causes of death were
57
58
59
60

1
2
3 complications from burns and drowning. A history of psychiatric disease was present in 14 cases
4 (70%), with psychopharmacological therapy in just seven cases (50%). Potential motives explaining
5 the fatal event that involved responsibilities of third parties were present in three cases; features of
6 the deceased suggesting a victimological role were present in six cases.
7
8
9

10 11 *Homicide vs. Suicide*

12
13 Six parameters were significantly different in the two groups, as shown in Table 2. Our results
14 revealed an independent statistical association between potential motives explaining the crime
15 (p -value < 0.001; OR = 27.533; 95% CI 5.210–145.511) and homicide, based on multiple logistic
16 regression analyses (Table 3). The absence of clothing lacerations was inversely associated with
17 homicide (p -value of 0.002; OR = 0.092; 95% CI 0.020–0.423).
18
19
20
21
22
23
24
25

26 27 **Discussion**

28
29 In some cases, sharp force fatalities represent a challenge for the medical examiner appointed to
30 distinguish between homicide and suicide events, and unusual suicide cases have been reported
31 (16,20,26). Our study confirms the results of previous studies on necroscopic and circumstantial data,
32 and it is an innovative contribution to the analysis of psychopathological–criminological aspects of
33 sharp force fatalities.
34
35
36
37
38
39

40 41 *Personal Data*

42
43 In our cases, among the homicide victims, there was a predominance of male subjects (18 out of 31,
44 58.1%) who were aged 25–44, which is in accordance with recent Italian studies (3); however,
45 divergent results have been reported in the international literature regarding the sex ratio in sharp
46 force homicide cases (8,9,11,16,27–29). Our results support the evidence that violent methods of self-
47 destruction are more frequently used by men, with 85% of male subjects in the suicide group (15). It
48 has been suggested that women use less lethal methods, resulting in a higher number of failed suicides
49 (15).
50
51
52
53
54
55
56
57
58
59
60

1
2
3 The age of the victim was not significantly different between the homicide and suicide groups. This
4 is in contrast to previous studies that showed a predominance of younger victims in homicide cases,
5 presumably because of the inclusion in such studies of infants and children, who are potential victims
6 of murder but do not commit suicide (8,9,16,27,30,31).
7
8
9
10

11 *Circumstantial Data*

12
13
14 Our results confirmed that with respect to both manners of death, the location of the death was
15 frequently the victim's home, suggesting the presence of a closer relationship between victim and
16 perpetrator in homicides. In particular, a higher degree of interrelationship has been reported for
17 women, as they tend to be killed in their own homes more frequently than men (11,13,14,19,32).
18
19
20
21
22

23 *Scene of Death*

24
25
26 The presence of blood stains far from the corpse was associated with a homicide event, suggesting
27 movement of the murderer and/or the victim (19). A kitchen knife was the most frequently used
28 weapon, and its position, while more often present next to the corpse in a suicide, did not show
29 statistical significance in differentiating between the two dynamics. Moreover, a position nearer to
30 the corpse did not necessarily indicate suicide, as a murderer may leave the weapon to simulate
31 suicide. The finding of a note, a will, or a previous declaration of suicidal intent has been found to be
32 related to suicide, which was demonstrated by Karlsson et al. (12) in a model based on multivariate
33 analysis.
34
35
36
37
38
39
40
41
42
43

44 *Necroscopic Data*

45
46
47 The absence of clothing damage was negatively associated with a homicidal dynamic according to
48 multivariate analysis. Accordingly, clothing damage was the strongest predictor of death being caused
49 by homicide in a model based on multivariate analysis by Karlsson et al. (12). In a typical suicide,
50 injuries are sustained at sites not covered by clothing or after clothing has been pulled aside to expose
51 skin. Though commonly seen in homicide, clothing damage is not infrequently encountered as an
52 atypical feature in suicidal events: in our sample, four cases out of 20 (20%) had clothing lacerations,
53 in keeping with findings from De Giorgio et al. (23%) (19) and Start et al. (28%) (31); Fukube et al.
54
55
56
57
58
59
60

1
2
3 (20) and Karger et al. (16) reported higher rates (respectively, 39% and more than 50%). It has been
4
5 proposed that the absence of hesitation marks or the presence of damage to the clothing may indicate
6
7 a strong motivation to commit suicide in a victim with a psychiatric history (33). This evidence
8
9 highlights that clothing damage should not be considered an absolute indicator of homicide, and it
10
11 instead needs to be integrated with other findings.
12
13

14
15 With regard to the number of injuries, we observed a significant difference between murder and
16
17 suicide, even after the exclusion of case 13, with 120 lesions. There was a greater number of injuries
18
19 inflicted in homicide cases (a median of seven in homicides, with an interquartile range of 2.5–15,
20
21 versus a median of three in suicides, with a range of 1–5.25, tentative wounds excluded); however,
22
23 variability was present in both groups. It has to be noted, however, that single stab homicides are not
24
25 a rare event, with reports of rates varying from 22% to 67% (11,16,34). There are also atypical
26
27 suicides reported with more than 60 sharp force wounds (16,20,26,33,35). The self-infliction of
28
29 multiple injuries may derive from the failure to inflict a single lethal injury or from a desire for self-
30
31 punishment (26). The total number of injuries is therefore consistently considered a less reliable
32
33 parameter for differentiating between dynamics (19).
34
35
36

37
38 An analysis of the locations of lesions pointed to differences between the manners of death. In the
39
40 typical suicide case, the choice of site for self-infliction of a wound depends on the existence of a
41
42 readily accessible region of the body; the avoidance of sensitive areas such as genitalia, lips, and eyes;
43
44 the avoidance of solid anatomic structures such as bones; and the victim's belief about the anatomic
45
46 position of vital structures such as the heart or arteries in the neck (20,26). Our results are consistent
47
48 with the literature in showing the region of the neck, the left anterior chest, the abdomen, and the
49
50 anterior surface of the forearms were the most frequently injured sites (16,19,22,33,36).
51
52

53
54 Homicide victims usually do not have control over the site of injury, and indeed, we observed injuries
55
56 to bony regions such as the face (23% of the cases) or head (19% of the cases). Sharp wounds in the
57
58 back were also a frequent occurrence (42%) in homicides but were not present at all in the suicide
59
60 cases. These locations are considered strong indicators of homicide (9,12,29). The left chest was more

1
2
3 frequently injured in both manners of death, probably because of beliefs about the heart's anatomic
4 position and/or the composition of the population in relation to a predominance of right-handed
5 subjects.
6
7
8

9
10 The presence of defensive and tentative wounds were strongly associated with, respectively, homicide
11 and suicide. Injuries to the posterior surface of the forearms and to the hands were seen exclusively
12 in homicide cases and corresponded to defensive wounds (with the exception of one suicide victim
13 in a homicide–suicide case). These injuries occur when the victim raises the upper limbs to protect
14 themselves against the assault (passive defense injury) or tries to ward off the weapon by grasping it
15 (active defense injury). We observed a higher incidence of such injuries compared to what has been
16 reported in the literature (64.5% vs. 37.1%–49.5%) (11,19,36). Tentative injuries are superficial stabs
17 or cuts often seen in close proximity to the fatal wound and parallel to each other, with a lower
18 dispersion than defensive wounds. Our results are comparable to those described in previous studies,
19 as tentative injuries were present in 50% of the cases and confirm that injuries to the upper limbs,
20 except for the anterior surface of the forearm, are rarely seen in a suicidal event (8,19,21,27).
21
22
23
24
25
26
27
28
29
30
31
32
33
34

35 Both tentative and defensive wounds may be missing in atypical scenarios; defensive-type injuries
36 can occur in suicide cases, and conversely, hesitation marks have been described in homicide cases
37 (16,19,21,27,33). In an atypical scenario, such as the aforementioned ones, a psychopathological and
38 criminological analysis may be useful for determining the manner of death.
39
40
41
42
43

44 *Psychopathology*

45
46 Several studies have shown that, as opposed to homicide, more than 90% of people who commit
47 suicide have a diagnosable psychopathological disorder (16,31,37–39). Our results are in keeping
48 with these findings. Interestingly, we found that among patients with a mental disorder, only 50%
49 were on treatment with pharmacological therapy. This observation may derive from low compliance
50 by these patients and/or an underestimation of the clinical situation by doctors. Any causal inference
51 to the death occurrence must take into account the toxicological evidence, which was not available in
52 many cases. As reported in our study, the diseases most frequently associated with suicide are mood
53
54
55
56
57
58
59
60

1
2
3 disorders. Depressive syndromes were present in 80% of the cases, and psychoactive substance abuse
4
5 (drugs and alcohol) is the second most common risk factor. Other diagnoses include schizophrenia,
6
7 borderline personality disorder, and dementia (21,40).
8

9 10 *Criminology*

11
12 In Italy, domestic and criminal homicides are the most frequent homicidal incidents (41). In recent
13
14 years, an important drop has been observed in homicides related to organized crime, especially in the
15
16 central-south area, explaining the relative increase in the proportion of female homicide victims (3).
17
18 Around 80.5% of female victims are killed by an acquaintance, whereas this is true for only 24.8%
19
20 of male victims. A frequent scenario is, indeed, that of a family member, generally a man, who
21
22 assaults other relatives, often the spouse (3,41).
23
24

25
26 Sharp force violence is, in particular, an offense of a domestic nature: compared to men, a higher
27
28 degree of interrelationship between perpetrator and female victim is suggested by the fact that they
29
30 are more frequently killed in their own homes and tend to suffer a larger number of injuries, including
31
32 to the upper extremities and superficial thoracic injuries (“scratches”) (3,11,13,14,30,32,42). The
33
34 escalation of a chronic conflict within a family is the most common motive for domestic homicide
35
36 (11,41).
37
38

39
40 Our findings are in keeping with the foregoing considerations, as the majority of homicides (54.8%)
41
42 in our case study occurred in a family context. In particular, a potential motive explaining the fatal
43
44 event that involved responsibilities of third parties was present in 90.3% of the cases, and the
45
46 existence of an interpersonal conflict against a psychopathological background of the perpetrator was
47
48 the most frequent (38.5%) scenario, suggesting that the management of the psychiatric patient is
49
50 sometimes very delicate in relation to not only his or her health but also with respect to people in
51
52 close relationships with the individual, such as immediate family or a partner. Jealousy is also a
53
54 frequent motive, and in our study, it was the second most prevalent motive (41). The presence of
55
56 potential motives explaining the crime was an independent factor associated with homicide in our
57
58
59
60

1
2
3 study, prompting the need for a careful criminological evaluation in cases where classic necroscopic
4 data are missing.
5
6

7 A general victimological role is suggested by the presence of features of the victim that may interfere
8 with an appropriate response to the assault (e.g., alcohol/drug intoxication and other vulnerabilities
9 such as being socially marginalized) (41). Characteristics of the deceased suggesting a victimological
10 role were predominant in homicide victims (58.06%), although statistical significance was not
11 reached ($p = 0.05$).
12
13
14
15
16
17
18
19

20 **Conclusions and Limitations of the Study**

21
22 The number of subjects in our study was relatively small, and the documentation was not consistently
23 available, thereby preventing further analysis with stratification. Also, considering the low frequency
24 of sharp force suicidal methods in Italy, the design of a multicentric study may be the best perspective
25 to overcome these criticalities. Differentiation between suicidal and homicidal sharp force violence
26 can be successfully achieved through an integrated evaluation of data derived from the crime scene
27 investigation and external examination, in most cases. In accordance with previous studies, the
28 evaluation of clothing damage is of paramount importance.
29
30
31
32
33
34
35
36
37

38 Nevertheless, classic necroscopic features may be missing in atypical cases, requiring that particular
39 attention should be given to the identification of **criminological aspects like** potential motives
40 explaining the crime. In our study, approximately one out of every three cases involved the perpetrator
41 being in a close relationship with the deceased and where the perpetrator suffered from psychiatric
42 disorders. Additionally, the majority of the homicides occurred in a family context.
43
44
45
46
47
48
49
50
51

52 **References**

- 53
54 1. WHO - World Health Organization. **Homicide WHO Global Health Estimates (2015 update)**
55 <http://apps.who.int/violence-info/homicide/>. (Accessed July 3, 2019).
56
57
- 58 2. Terranova C, Zen M. Women victims of intentional homicide in Italy: New insights comparing
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Italian trends to German and U.S. trends, 2008-2014. *J Forensic Leg Med* 2018;53:73-8.
doi:10.1016/j.jflm.2017.11.007

3. ISTAT - Italian Institute of Statistics. Le Vittime di Omicidio - 2018 [Homicide victims - 2018]. <https://www.istat.it/it/archivio/223679> (Accessed July 26, 2019).
4. Terranova C, Bevilacqua G, Zen M, Montisci M. Crimes against the elderly in Italy, 2007–2014. *J Forensic Leg Med* 2017; 50:20-27. doi: 10.1016/j.jflm.2017.06.005.
5. WHO - World Health Organization. Mental Health- 2019. https://www.who.int/mental_health/prevention/suicide/suicideprevent/en/. (Accessed July 3, 2019).
6. WHO - World Health Organization. Suicide. <http://apps.who.int/gho/data/node.sdg.3-4-viz-2?lang=en>. (Accessed July 4, 2019).
7. ISTAT - Italian Institute of Statistics. Suicidi [Suicide]. <https://www.istat.it/it/archivio/suicidi>. (Accessed July 4, 2019).
8. Vassalini M, Verzeletti A, De Ferrari F. Sharp force injury fatalities: A retrospective study (1982-2012) in Brescia (Italy). *J Forensic Sci* 2014; 59(6):1568-74. doi: 10.1111/1556-4029.12487
9. Brunel C, Fermanian C, Durigon M, de la Grandmaison GL. Homicidal and suicidal sharp force fatalities: Autopsy parameters in relation to the manner of death. *Forensic Sci Int* 2010;198(1-3):150-4. doi:10.1016/j.forsciint.2010.02.017
10. Bartolomeo F. Inchiesta Con Analisi Statistica Sul Femminicidio in Italia [Investigation and statistical analysis on femicide in Italy] - 2016. <https://www.istat.it/it/files/2017/11/Analisi-delle-sentenze-di-Femminicidio-Ministero-di-Giustizia.pdf> (Accessed July 4, 2019).
11. Bohnert M, Hüttemann H, Schmidt U. Homicides by Sharp Force. In: Tsokos M Editor. *Forensic Pathology Reviews*. Totowa, NJ: Humana Press Inc., 2007; 65-89. doi:10.1007/978-1-59259-921-9_3
12. Karlsson T. Multivariate analysis ('Forensiometrics') - A new tool in forensic medicine.

- 1
2
3 Differentiation between sharp force homicide and suicide. *Forensic Sci Int* 1998;94(3):183-
4 200. doi:10.1016/S0379-0738(98)00065-6
5
6
7
8 13. Karlsson T. Multivariate analysis ('Forensiometrics') - A new tool in forensic medicine:
9 Findings on the victim of sharp-force homicide can predict the inter-relationship with the
10 perpetrator. *Forensic Sci Int* 1999;101(1):33-41. doi:10.1016/S0379-0738(99)00007-9
11
12
13
14 14. Rogde S, Hougen HP, Poulsen K. Homicide by sharp force in two Scandinavian capitals.
15 *Forensic Sci Int* 2000; 109(2):135-45. doi:10.1016/S0379-0738(99)00230-3
16
17
18
19 15. Massaro L. Unusual Suicide in Italy: Criminological and Medico-Legal Observations-A
20 Proposed Definition of "Atypical Suicide" Suitable for International Application. *J Forensic*
21 *Sci* 2015;60(3):790-800. doi:10.1111/1556-4029.12731
22
23
24
25
26 16. Karger B, Niemeyer J, Brinkmann B. Suicides by sharp force: Typical and atypical features.
27 *Int J Legal Med* 2000; 113(5):259-62. doi:10.1007/s004149900093
28
29
30
31 17. Harvard T.H. Chan School of Public Health. Lethality of Suicide Methods.
32 <https://www.hsph.harvard.edu/means-matter/means-matter/case-fatality/>. (Accessed July 4,
33 2019).
34
35
36
37
38 18. Viel G, Cecchetto G, Montisci M. An unusual case of suicide by sharp force. *Forensic Sci Int*.
39 2009;184(1-3):12-15. doi:10.1016/j.forsciint.2008.11.006
40
41
42
43 19. De-Giorgio F, Lodise M, Quaranta G, Spagnolo AG, d'Aloja E, Pascali VL, et al. Suicidal or
44 homicidal sharp force injuries? A review and critical analysis of the heterogeneity in the
45 forensic literature. *J Forensic Sci* 2015; 60 Suppl 1:S97-107. doi: 10.1111/1556-4029.12673
46
47
48
49 20. Fukube S, Hayashi T, Ishida Y, Kamon H, Kawaguchi M, Kimura A, et al. Retrospective study
50 on suicidal cases by sharp force injuries. *J Forensic Leg Med* 2008;15(3):163-167.
51 doi:10.1016/j.jflm.2007.08.006
52
53
54
55
56 21. Karakasi MV, Nastoulis E, Kapetanakis S, Vasilikos E, Kyropoulos G, Pavlidis P. Hesitation
57 Wounds and Sharp Force Injuries in Forensic Pathology and Psychiatry: Multidisciplinary
58 Review of the Literature and Study of Two Cases. *J Forensic Sci* 2016;61(6):1515-1523.
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

doi:10.1111/1556-4029.13146

22. Mazzolo GM, Desinan L. Sharp force fatalities: Suicide, homicide or accident? A series of 21 cases. *Forensic Sci Int* 2005;147(Suppl.):2004-2006. doi:10.1016/j.forsciint.2004.09.097
23. Pelletti G, Visentin S, Rago C, Cecchetto G, Montisci M. Alteration of the Death Scene After Self-stabbing: A Case of Sharp Force Suicide Disguised by the Victim as a Homicide? *J Forensic Sci*. 2017;62(5):1395-1398. doi:10.1111/1556-4029.13440
24. Visentin S, Massaro L, Viel G, Cecchetto G, Montisci M. Suicide identification during on-site inspection. Proposal and application of an interpretative method for death scene investigation. *Forensic Sci Int* 2019; 297:148-155. doi:10.1016/j.forsciint.2019.01.029
25. Ohshima T, Kondo T. Eight cases of suicide by self-cutting or -stabbing: Consideration from medico-legal viewpoints of differentiation between suicide and homicide. *J Clin Forensic Med* 1997;4(3):127-132. doi:10.1016/S1353-1131(97)90092-4
26. Austin AE, Guddat SS, Tsokos M, Gilbert JD, Byard RW. Multiple injuries in suicide simulating homicide: Report of three cases. *J Forensic Leg Med* 2013;20(6):601-604. doi:10.1016/j.jflm.2013.02.005
27. Karlsson T. Homicidal and suicidal sharp force fatalities in Stockholm, Sweden. Orientation of entrance wounds in stabs gives information in the classification. *Forensic Sci Int* 1998;93(1):21-32. doi:10.1016/S0379-0738(98)00025-5
28. Ormstad K, Karlsson T, Enkler L, Law B, Rajs J. Patterns in sharp force fatalities--a comprehensive forensic medical study. *J Forensic Sci* 1986;31(2):529-542. doi:10.1520/jfs12284j
29. Ambade VN, Godbole HV. Comparison of wound patterns in homicide by sharp and blunt force. *Forensic Sci Int* 2006;156(2-3):166-170. doi:10.1016/j.forsciint.2004.12.027
30. Karlsson T, Ormstad K, Rajs J. Patterns in Sharp Force Fatalities—A Comprehensive Forensic Medical Study: Part 2. Suicidal Sharp Force Injury in the Stockholm Area 1972–1984. *J Forensic Sci* 1988; 33(2):448-61. doi:10.1520/jfs11958j

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

42. Schmidt PH, Padosch SA, Rothschild MA, Madea B. Forensic case profiling aspects on multiple homicides from the Cologne-Bonn Metropolitan Area 1985-2000. *Forensic Sci Int.* 2005; 153(2-3):168-73. doi:10.1016/j.forsciint.2004.09.104

For Peer Review

Table 1. Data included in the collection form.

Personal data
✓ nationality and gender
✓ age
✓ marital status and parenthood
✓ education
✓ occupation
<hr/>
Circumstantial data and premeditation
✓ year, month, day of the week
✓ time of occurrence
✓ place of occurrence
✓ presence of third party
✓ presence of explanatory notes, wills or previous threats of suicide
<hr/>
Scene of the event
✓ presence of the weapon
✓ localization of the weapon
✓ type of weapon
✓ presence of blood stains distant from the corpse
<hr/>
Necroscopic and toxicological data
✓ clothing lacerations
✓ characteristics of injuries (number, location, stab/incised)
✓ hesitation wounds (number, location)
✓ defence wounds (number)
✓ location of lesions and dominant hand
✓ alcohol
✓ drugs
<hr/>
Clinical data
✓ diagnosis of physical diseases
✓ diagnosis of mental disorders
<hr/>
Criminological and victimological data
✓ potential motives explaining the crime
✓ features of the deceased suggesting a victimological role.

Table 2. Demographic, crime scene investigation, necroscopic and criminological data among cases (homicides) and controls (suicides).

Variable	Total	Homicide	Suicide	P-value*	OR	95% CI
	N=51	N=31	N=20			
Gender						
Female, n (%)	16 (31.4)	13 (41.9)	3 (15.0)	0.064	4.093	0.990-16.925
Male, n (%)	35 (68.6)	18 (58.1)	17 (85.0)			
Nationality						
Italian, n (%)	38 (74.5)	20 (64.5)	18 (90.0)	0.053	0.202	0.039-1.037
Non-Italian, n (%)	13 (25.5)	11 (35.5)	2 (10.0)			
Age, years, median (interquartile range)	43.5 (35.25-53)	43.5 (34-53)	45 (37.75-54.5)	0.627	1.010†	0.975-1.016
Weapon far from the body, n (%)	11 (21.56)	8 (25.8)	3 (15)	0.32	2.061	0.474-8.963
Blood stains far from the body, n (%)	16 (31.37)	14 (45.16)	2 (10)	<0.01	8.400	1.642-42.974
Clothing lacerations, n (%)	26 (50.98)	22 (70.96)	4 (20)	<0.01	9.778	2.554-37.430
Hesitation wounds, n (%)	10 (19.60)	0 (0)	10 (50)	<0.01	-	-
Defense wounds, n (%)	21 (41.17)	20 (64.51)	1 (5)	<0.01	34.545	4.059-293.983
Number of injuries, median (interquartile range)	5 (2-11)	7 (2.5-15)	3 (1-5.25)	0.021	1.069†	1.007-1.135
Potential motives explaining the crime, n (%)	31 (60.78)	28 (90.32)	3 (15)	<0.01	52.889	9.566-292.424
Features of the deceased suggesting a victimological role, n (%)	24 (47.05)	18 (58.06)	6 (30)	0.05	3.231	0.980-10.653

* P-value refer to chi-square test (Fisher's exact test) for dichotomous variables and to Wilcoxon rank sum Test for continuous variables.

† OR (95% CI) for age and number of injuries (continuous variables) refer to univariate logistic regression analysis.

1
2
3 Table 3. P-Value, Odds ratio and Confidence interval of the variables associated to homicide cases
4
5 using multiple logistic regression model.
6

7

8 Variable	P-value	OR	95% CI
9 Lack of Clothing lacerations	0.002	0.092	0.02-0.42
10			
11 Blood stains distant from the body	0.22	0.43	(0.096-1.930)
12			
13 Number of injuries	0.27	1.065	(0.962 – 1.180)
14			
15 Potential motives explaining the crime	<0.001	27.533	5.21-145.51
16			

17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For Peer Review

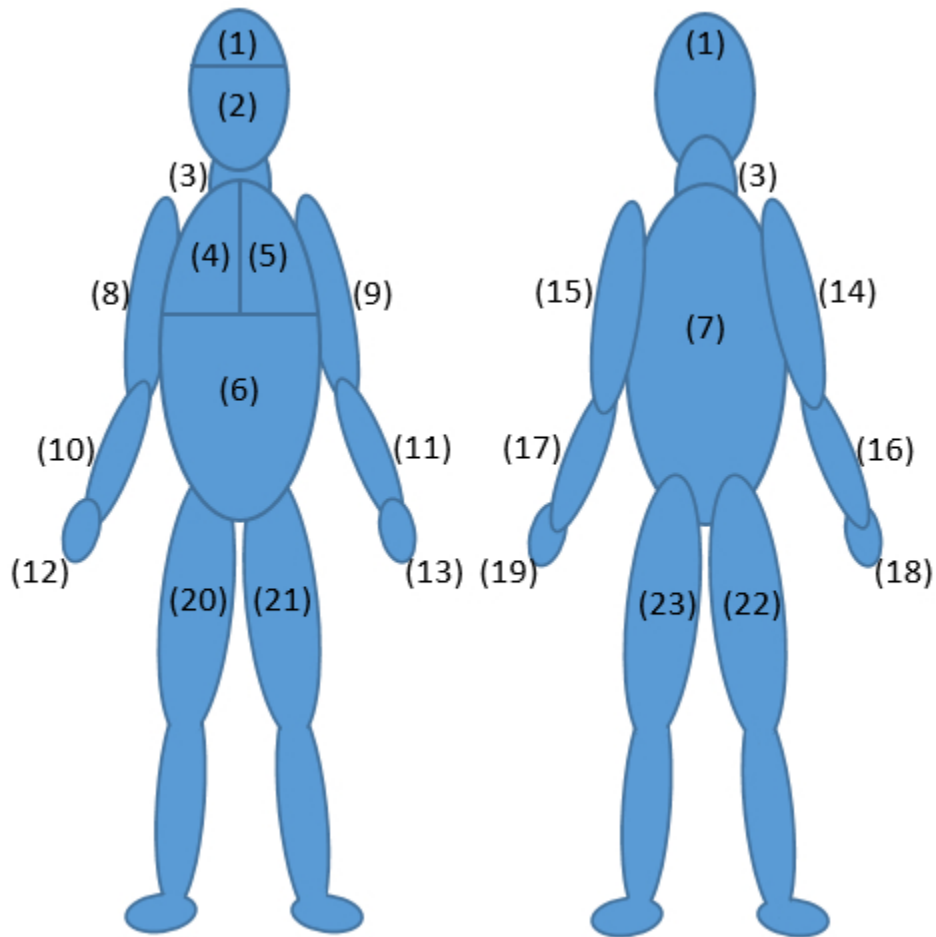
Figures Legends

FIG. 1—Distribution of injuries: (1) head; (2) face; (3) neck; (4) right anterior chest; (5) left anterior chest; (6) abdomen; (7) posterior chest; (8) right anterior arm; (9) left anterior arm; (10) right anterior forearm; (11) left anterior forearm; (12) right anterior hand; (13) left anterior hand; (14) right posterior arm; (15) left posterior arm; (16) right posterior forearm; (17) left posterior forearm; (18) right posterior hand; (19) left posterior hand; (20) right anterior lower limb; (21) left anterior lower limb; (22) right posterior lower limb; and (23) left posterior lower limb. Modified from Vassalini et al. (8).

FIG. 2—Distribution of homicidal injuries by percentage (darker colors correspond to the more frequently injured body areas). Additional locations that were present in less than 10% of the cases included the right posterior arm, left anterior arm, left posterior arm, right posterior hand, and left posterior lower limb.

FIG. 3—Distribution of hesitation marks by percentage (darker colors correspond to the more frequently injured body areas). Injuries to the head, face, anterior surface of the left chest, arms, and right inferior limb were also present in 5% of the cases (not shown).

FIG. 4—Distribution of suicidal wounds, tentative injuries excluded, by percentage (darker colors correspond to more frequently injured body areas). Additional locations were the anterior surface of the right chest and the left inferior limb, seen in 5% of the cases (not shown).



Distribution of injuries: (1) head; (2) face; (3) neck; (4) right anterior chest; (5) left anterior chest; (6) abdomen; (7) posterior chest; (8) right anterior arm; (9) left anterior arm; (10) right anterior forearm; (11) left anterior forearm; (12) right anterior hand; (13) left anterior hand; (14) right posterior arm; (15) left posterior arm; (16) right posterior forearm; (17) left posterior forearm; (18) right posterior hand; (19) left posterior hand; (20) right anterior lower limb; (21) left anterior lower limb; (22) right posterior lower limb; and (23) left posterior lower limb. Modified from Vassalini et al. (8).

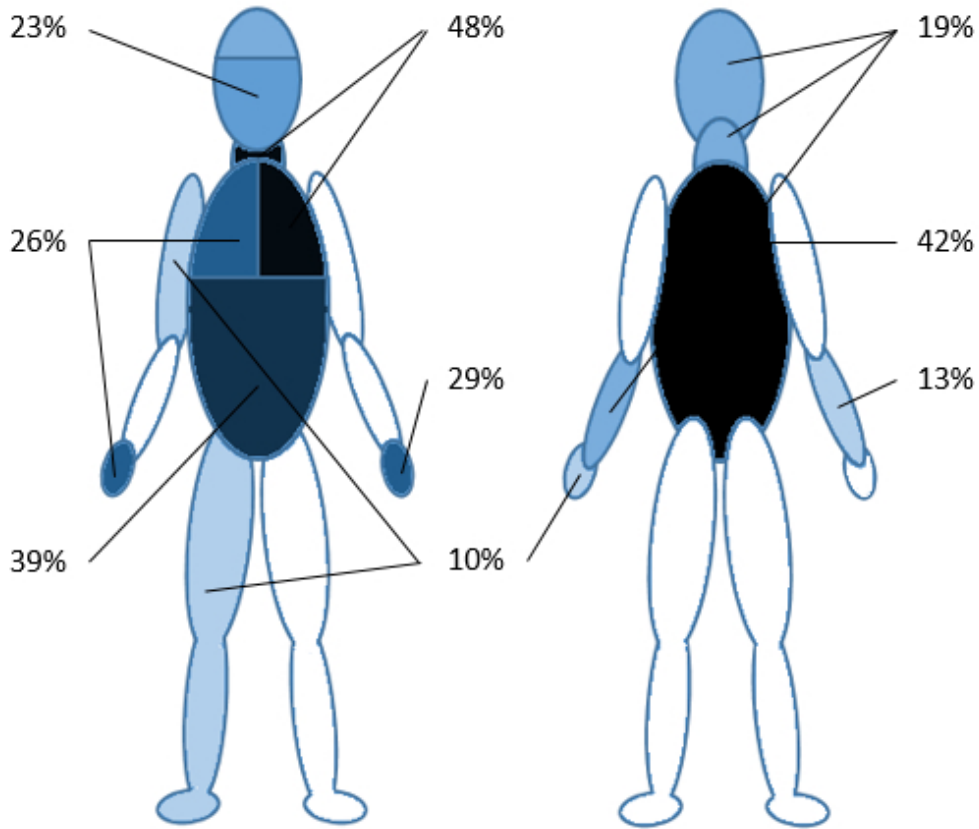


FIG. 2—Distribution of homicidal injuries by percentage (darker colors correspond to the more frequently injured body areas). Additional locations that were present in less than 10% of the cases included the right posterior arm, left anterior arm, left posterior arm, right posterior hand, and left posterior lower limb.

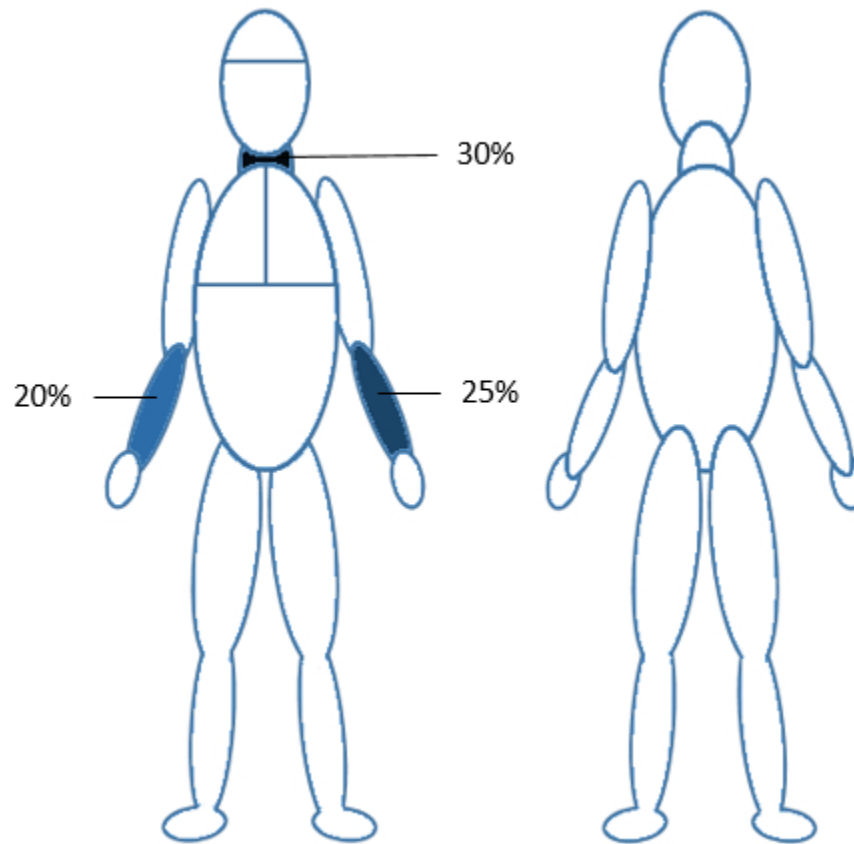


FIG. 3—Distribution of hesitation marks by percentage (darker colors correspond to the more frequently injured body areas). Injuries to the head, face, anterior surface of the left chest, arms, and right inferior limb were also present in 5% of the cases (not shown).

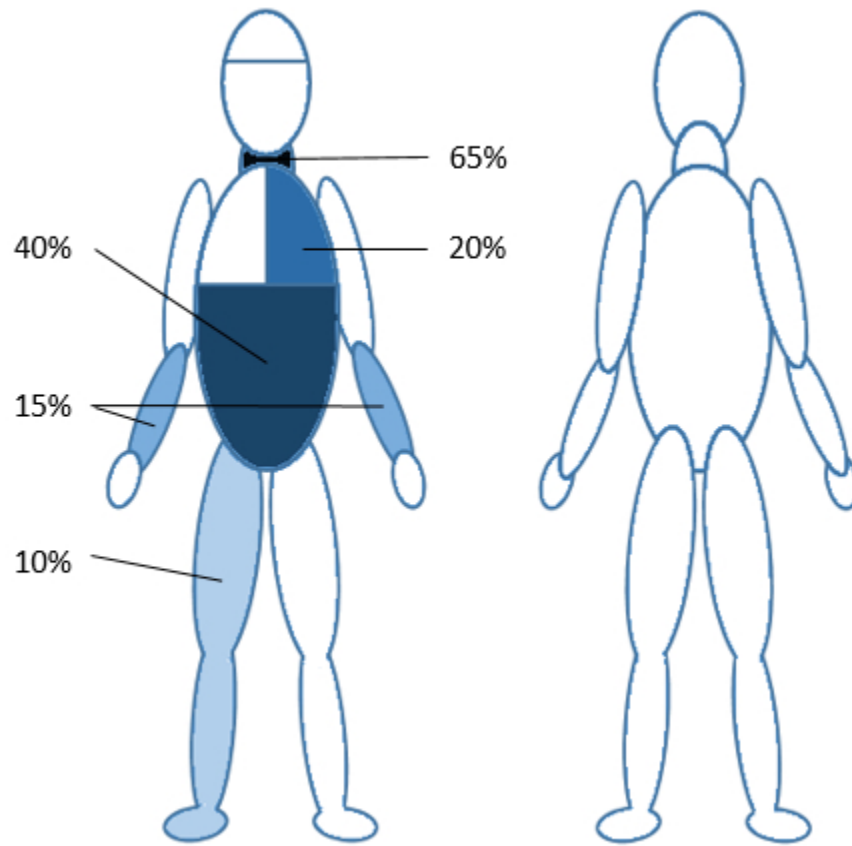


FIG. 4—Distribution of suicidal wounds, tentative injuries excluded, by percentage (darker colors correspond to more frequently injured body areas). Additional locations were the anterior surface of the right chest and the left inferior limb, seen in 5% of the cases (not shown).