



Intimate Partner Homicide Suicide: a Mini-Review of the Literature (2012–2018)

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Published online: 21 February 2019
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Abstract

Recent Findings In homicide-suicide (HS), a perpetrator kills at least one victim and then commits suicide within a time frame, which is not consistently described in the literature. Most HS happen in an intimate partner relationship (HS-IP), but data about this phenomenon are still scant and poorly systematized.

Purpose of Review To assess the research papers published about HS-IP from 2012 to 2018 in Pubmed and Scopus. Article selection followed the PRISMA flow diagram. Information was extracted from the selected articles and tabulated.

Summary The 22 eligible articles focusing on different types of HS, including HS-IP, suggest that HS-IPs are predominantly committed by men, usually married, cohabiting, or recently separated from their partner, with a medium-low employment status; the victim is usually the current or former female partner. Heterogeneity of HS makes it difficult to generalize the results. Implications emerge for the need to target domestic violence and firearm regulation.

Keywords Homicide · Suicide · Intimate partner violence · Mercy killing

Introduction

Murder-suicide, homicide-suicide, and dyadic death (later indicated as HS) are phrases used to indicate a situation where a perpetrator kills at least one victim and then commits suicide [1–3]. To represent an actual HS, the homicide(s) (H) and suicide (S) must occur within a time frame which is not

consistently described in the literature: for some authors the time elapsed between the H and S should be no longer than 24 h, while others adopt as inclusion criterion also a several days time frame, up to a week, and still others do not use a timeline at all [4–13].

Theoretical understanding of the HS phenomenon from a psychological perspective proposes two main positions: the event is considered essentially homicidal by the first, with suicide being a concomitant event likely due to remorse, while the second position maintains that HS is essentially a two-staged suicide, extended to the perpetrator's intimates [10, 11, 14–20]. Besides, other authors have suggested that HS is a distinct phenomenon from both H and S [21, 22].

Some classification models have been proposed for HS. The model by Marzuk and coworkers (1992) [10], later modified by Hanzlick & Koponen (1994) [23], discriminates among five types of HS, based on *type* (the relationship between victim and offender) and *class* (principal offenders' motive or precipitating factor) [10, 23]. According to type, the most common type of domestic homicide and the most prevalent in overall HS cases is the killing of an intimate partner followed by suicide [9, 10, 24–29]. Marzuk (1992) proposes two motives for spousal or intimate partner HS: revenge and declining health [10]. The typology proposed by

This article is part of the Topical Collection on *Mood Disorders*

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Harper and Voigt (2007) includes intimate or domestic lethal violence as the most common type of HS [30]. This is usually perpetrated by older male offenders, unemployed, with the victim being a current or former spouse or partner; furthermore, in older, middle-class offenders (aged also more than 75 years), the motive underlying HS is likely declining health, leading to the so-called mercy killing-suicide.

Briefly, while it is widely acknowledged that most HS happen in the context of an intimate partner relationship, data about this relatively rare phenomenon worldwide are still scant and overall poorly systematized. Therefore, the aim of this mini-review is to focus on this topic, assessing the research papers published since 2012.

Methods

We performed a review of the literature about HS and intimate partner violence, published from January 2012 to June 2018, with full text available and written in English. Moreover, we excluded book chapters, editorials, letters to the editor, and case reports. We searched articles in Pubmed and Scopus using the search strings reported in Appendix 1. Six of the authors (C.G., S.D.M., C.G., C.C., L.L., M.M.) reviewed and screened articles eligible according to the PRISMA (Preferred Reporting Items for Systematic Reviews and MetaAnalyses) flow diagram [31]. Article screening was based on title first, then on the abstract, and eventually on the full-text, to exclude those that were clearly not relevant to the review topic. Any disagreement among reviewers was resolved through group discussion. Additional records identified through other sources, such as the reference list of the papers included through database searching, were added.

Finally, each reviewer extracted and tabulated the following information from each article: perpetrators' and victims' age, gender, race/ethnicity, marital status or victim-perpetrator relationship, socio-economic, educational, employment status; cause of death for both H and S; autopsy findings, including toxicology; alcohol/drug consumption; health status, medical history; psychiatric symptoms/ diagnosis/treatment; previous suicide attempts; motive and latent motive for HS; evidence of prior threats to kill, history of domestic abuse; previous criminal history; and suicide notes.

Results

The selection process of the articles is shown in Fig. 1; 12 articles were identified through database search and 10 from other sources, so we eventually examined 22 articles. The included studies are grouped according to the Country where they were performed and summarized below. For an overview and more details see Table 1.

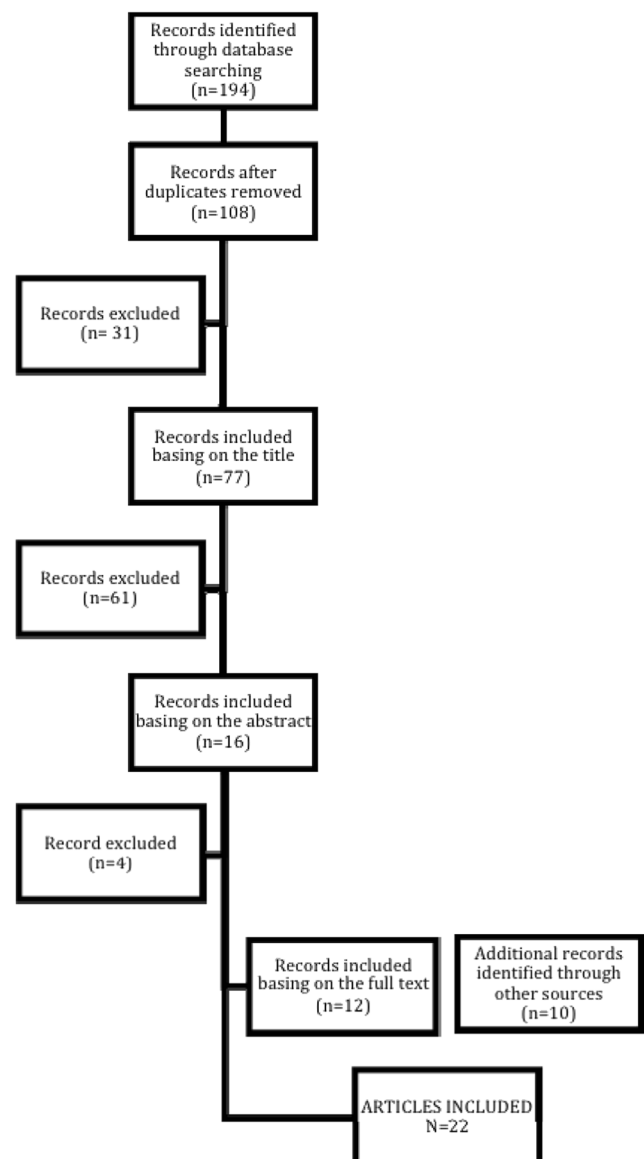


Fig. 1 PRISMA flow diagram and search strings. The diagram shows the process of the article selection

USA Studies

The largest study was performed by Reckdenwald [37] and included 1073 intimate partner HS (current intimate $N = 868$, former intimate $N = 172$) out of 1718 HS cases in the 10-year period from 2003 to 2013. Most HS happened in White couples; most perpetrators were males (94.87%), and most victims were females (94.32%). The method was shooting in 80.62% of cases; wound location and number were also specified in this study, which anyway did not report about HS motives.

Salari [36] reported about 718 intimate partner HS in the period 1999–2005 and provided details about primary homicidal (48%) or suicidal (27%) ideation. Moreover, the Salari

Table 1 Results

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Adinkrah 2014	Ghana 1990–2009 HS = 50 IP = 36	Newspaper (Daily Graphic)	Sexual jealousy; infidelity; end of relations; quarrels	Male 97.2% Age: 20–70 years Low socio-economic background	Females 97.2% Age 18–60 years Primarily dependent on husbands. Low socio-economic status	Homicide: firearm 62.9%; cutting with a machete 28.9%; strangulation 5.7%; ablaize 2.9%; Suicide: firearm 51.4%; poison 20%; hanging 14.3%; self-inflicted knife wounds 5.7% Not specified
Balica 2016	Romania 2002–2013 HS = 83 IP = 57	Police files penal files (Parquet of Bucharest) online searches of newspapers and internet outlets	69%: IP HS Main motives: end relationship, jealousy, suspicion of unfaithfulness, infidelity, financial difficulties, mental illness.	Main gender: male (93.9%) Mean age: 44.5% of the perpetrators were between 40 and 64 years Profession: 48.3% had low occupational mansion Psychological disorders: reported in 12.1% of the cases Substance abuse: alcohol abuse reported in 21.6% of the cases Not specified	Main gender: female (74.3%) Mean age: 29.5% of the victims were between 25 and 39 years and 24.7% between 40 and 64 years Profession: not mentioned in 52.4%, in 40.9% victims had a low occupational status	Not specified
Bridges 2013	USA 1968–1975 HS = 184 IP = 122	Supplementary homicide reports taken from FBI's Uniform Crime Reporting Program Data for 1968–1978	Not specified	Not specified	Females 81% Mean age: 72.8 years	Handguns 80%, Other—not specified-20%
Burgess 2015	USA 2001–2011 HS = 252 IP = 165	Archival files from the offices of the County Medical Examiners of HS deaths for persons who underwent autopsy	Domestic conflict; consortial-physical ailing; health issues	Males Mean age 48.51 MARRITAL STATUS: single 27.6%; partnered 54.1%; separated/divorced 18.4% 7.6% history of prior drug and alcohol related arrest 15.2% at least one past arrest for violent offense	Females Mean age 40.73.	Gunshot blunt force trauma (Caucasians); cutting instrument (African Americans, Hispanics, Asians)
Cengija 2012	Croatia 1986–2009 HS = 17 IP = 13	Death certificates and judicial autopsy from the Department of Forensic Medicine and Criminalistics (Rijeka) Police investigation reports from police headquarters (Primorje-Gorski Kotar; Lika-Senj county) Archived articles of local newspaper Croatian Bureau of Statistics, 2001 census.	Combined HS events frequently committed between intimates (76% spousal or consortial HS) 35% amorous jealousy 29% separation between intimates 23% consequence of mental disorder of perpetrator	Main gender: male (82%) Mean age: 50 (male); 49 years; female 52 years) profession: 53% employed on low paid jobs, 6% unemployed 35% retired. Psychological disorders: two perpetrators had clinically diagnosed depression and the other two were psychotic Substance abuse: 62% sober, 1 perpetrator was boozey, 2 drunk, and 1 severely drunk.	<i>N</i> = 19 Main gender: female (74%) mean age: 40 (male); 48 years; female: 37 years) profession: 63% employed on low paid jobs, 10% unemployed, 10% retired. Substance abuse: 73% sober. Pattern of alcohol intoxication like the perpetrators' group.	In 76.5%, the weapon was the same in both H and S; same firearm (59%), explosive (12%), knife (6%). Only 50% of the firearms were legal. 94% the location for H was the same of S. 59% in private home. 76% suicide occur immediately or within few minutes; in 23% the interval between acts was longer, but did not exceed 90 min.
De Koning 2014	Belgium 1935–2019 <i>N</i> = 47	Ghent University Department of Legal Medicine; State Archive;	Offenders aged < 55 (<i>N</i> = 28); amorous jealousy (80%); (missing info <i>N</i> = 8) Offenders aged > 55 (<i>N</i> = 19): mercy killing/altruistic suicide	Offenders aged < 55 (<i>N</i> = 28): 96% men; mean age 40 years (range 21–68). Depression <i>N</i> = 2; alcohol use slightly more than	Offenders aged < 55 (<i>N</i> = 28): females; mean age 37 (range 20–52). Physical illness <i>N</i> = 2; no alcohol use in most of cases; medication <i>N</i> = 0. 71.4%.	

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
		Liberal newspaper archive in Ghent.	<i>N</i> = 14 (43%), amorous jealousy 36%, <i>N</i> = 3 familial, financial, social stressors (missing info <i>N</i> = 5) Jealousy mostly detected in men (43%); in females, only 1 case.	one third; B.A.C 1.25 g/L; medication <i>N</i> = 0. Offenders aged > 55 (<i>N</i> = 19): 95% males; mean age 63 years (range 58–81). 47% medical history; depression <i>N</i> = 4; alcohol intoxication in 27%; B.A.C 1.41 g/L; medication <i>N</i> = 1 (female offender, vesparax).	Offenders aged > 55 (<i>N</i> = 19): 95% females; mean age 62 years (range 55–82). Medical problems (mostly physical) <i>N</i> = 6 (32%); alcohol use before murder <i>N</i> = 2; barbiturates cocktail <i>N</i> = 1.	Victims: asphyxia (<i>N</i> = 2, 7.1%), sharp injury (<i>N</i> = 1, 3.6%), gunshot wounds (<i>N</i> = 20, 71.4%), blunt force (<i>N</i> = 3, 10.7%), other (<i>N</i> = 2, 7.1%), combined causes of death: fire + sharp injuries; sharp injuries + blunt force (<i>N</i> = 2). Offenders aged > 55 (<i>N</i> = 19): Offenders: asphyxia (<i>N</i> = 10, 52.6%), sharp injury (<i>N</i> = 1, 5.3%), gunshot wounds (<i>N</i> = 7, 36.8%), poisoning (<i>N</i> = 1, 5.3%), Victims: asphyxia (<i>N</i> = 4, 21.1%), sharp injury (<i>N</i> = 1, 5.3%), gunshot wounds (<i>N</i> = 8, 42.1%), blunt force (<i>N</i> = 6, 31.6%), other (<i>N</i> = 2, 7.1%) Homicide: knife (66%); hit (18%); firearms (6%); gas/oil/explosive/fire (4.5%); drug/poison (3%); unknown (1.5%). Suicide: knife (27%); gas/oil/explosive/fire (1.5%); drug/poison (27%); hanging (6%); immolation (4.5%); train (3%); jumped (6%); drowned (1.5%); unknown (2.2%) Same method for H and S: 24 cases Method of homicide: <i>N</i> = 22 sharp instrument; asphyxia; firearms. Method of suicide: median age: 38
Densley 2016	China 2000–2014 <i>N</i> = 63 IP = 32	Chinese Ministry of Public Security and journalistic sources	IP conflict: 38%; extra-marital affair: 12.5%;	Gender male (<i>N</i> = 60; 95%). Age: 19–30 (9.5%); 31–40 (25.5%); ≥ 41 (9.5%); unknown (55.5%)	Spousal HS: 11 (14%); spouse and children: 12; In-laws: 15; ex-spouse: 4; lover (consortial): 13	
Flynn 2016	England, Wales 2006–2008 <i>N</i> = 60, IP <i>N</i> = 45	National Confidential Inquiry into Suicide and by People with Mental Illness (NCISH), police records, general practitioner medical records, newspaper articles	Loss of a close personal relationship either through imminent separation or divorce, or a significant change in the relationship due to victim's health (e.g., dementia)	<i>N</i> = 60 Male 88% Median age: 44 Male: 53 years old Married/cohabiting: 32 Living alone: 9 Black or minority ethnic group: 17 Unemployed: 16 History of alcohol and/or misuse: 28 Previous domestic violence: 22 History of self-harm/attempted suicide: 14 Previously bereaved by suicide: 5 The HS offenders diverge in two groups: 1—with a history of depression (<i>N</i> = 28); previous suicide attempt: (<i>N</i> = 11); 2—with a history of perpetrating	<i>N</i> = 70 <i>N</i> = 45 IP, partner/spouse former or current Median age: 38 Female victims: 54 (77%) Unemployed 11 Ethnic minority 15 Relationship of victim to perpetrator: 45 spouse/partner current or ex; spouse + children (familicide); 2	

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Gregory 2012	UK, 1993–2007 <i>N</i> = 22 (<i>N</i> = 12 history of domestic abuse; <i>N</i> = 10 no history of domestic abuse).	Records of the Forensic Science Service for Yorkshire and the Humber; Coroners' files.	History of domestic abuse (<i>N</i> = 12): extreme jealousy (<i>N</i> = 1); partner about to leave the relationship (<i>N</i> = 6). No known history of domestic abuse (<i>N</i> = 10); jealousy (<i>N</i> = 6); woman attempting to leave the relationship (<i>N</i> = 9).	domestic violence (<i>N</i> = 22). There was an overlap of perpetrators with both a history of mental illness and of committing domestic violence. History of domestic abuse (<i>N</i> = 12): Male; mean age: 39 years; 90% white; 87% employed (manual jobs) at the time of the offense; 4 unemployed; 7/12 previous criminal history; 77% no previous convictions; 4/12 no previous convictions; 7/12 previous criminal records; 7/12 57% had previously physically or sexually abused their partner; 6 mental ill health; 3 previous suicide attempts; no illicit drug use; 1 has a blood alcohol level of 240 mg/100 ml. No known history of abuse (<i>N</i> = 10): male, mean age of 46 years. 5 manual workers; 3 non-manual workers including a company director; 1 retired; 1 unemployed; 1 onset of anxiety and depression; no illicit drug use; only 1 perpetrator slightly over the drink drive limit for alcohol; no criminal records, no documented history of violence.	History of domestic abuse (<i>N</i> = 12): 11 female, 1 male; mean age 31 years; 7/10 work, mainly in low status jobs such as retail, factory work and unqualified care work; student <i>N</i> = 1. IP HS (no known history of abuse) (<i>N</i> = 10): female, mean age of 39 years; 1 retired, 8 work in low status jobs, 1 company director.	History of domestic abuse (<i>N</i> = 12): H = strangulation (<i>N</i> = 3); compression of neck (<i>N</i> = 3); shooting (<i>N</i> = 1); burning (<i>N</i> = 1); stabbing (<i>N</i> = 2); multiple injuries (<i>N</i> = 1); stabbing and strangulation (<i>N</i> = 1); S = hanging (<i>N</i> = 6); burning (<i>N</i> = 1); drowning (<i>N</i> = 1); heart attack (<i>N</i> = 1); drug overdose (<i>N</i> = 1); incised wounds of upper limbs (<i>N</i> = 1); multiple injuries (<i>N</i> = 1). No known history of domestic abuse (<i>N</i> = 10): H = compression of neck (<i>N</i> = 1); stabbed (<i>N</i> = 1); multiple Injuries (<i>N</i> = 1); strangulation (<i>N</i> = 3); blunt head trauma (<i>N</i> = 2); shooting (<i>N</i> = 2); S = hanging (<i>N</i> = 3); multiple injuries (<i>N</i> = 1); car exhaust fumes (<i>N</i> = 1); drowning (<i>N</i> = 1); shooting (<i>N</i> = 2); carbon monoxide poisoning (<i>N</i> = 1); drug overdose (<i>N</i> = 1).
Manning 2014	USA 2005–2008 HS = 20 IP = 14	West Virginia's Domestic Violence Fatality Review Team (DVFR): data on all domestic homicides within the state including all cases reported to Office of the Chief Medical Examiner (OCME)	Loss of intimacy 70%; other 10%; mixed 5%; unknown 15%	Male <i>N</i> = 14 Mean age 45.9 Education varied from 8 to 20 years (mean 12.9) previous history of violence 55% White 90%; Black 5%; Hispanic 5%	Female <i>N</i> = 14 Mean age 42.7 Education varied from 8 to 16 years (mean 12.8) White 50%; Black 50%	Firearm 85%; sharp object 5%; blunt object 10%
Oliffé 2014	USA All articles published through February 2013 HS <i>n</i> = 45 IP = 7	Newspaper articles through two digital archiving publishers: ProQuest and NewsBank	Domestic desperation; financial adversity; work stress; health issue; mental illness (depression, dementia, pathologic gambling)	Male <i>N</i> = 7 Mean age 53	Female <i>N</i> = 7 Mean age = 48.28	Homicide: gunshot <i>n</i> = 4; strugling <i>n</i> = 1; stabbing <i>n</i> = 1; unknown <i>n</i> = 2; Suicide: gunshot <i>n</i> = 4; hanging <i>n</i> = 1; Unknown <i>n</i> = 2

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Panczak 2013	Switzerland 1990–2008 HS = 73 IP = 63	1990 census in Switzerland and data from SNC (a longitudinal mortality study of the whole Swiss population, based on linkage of the 1990 and 2000 census data containing mortality records)	Not mentioned	<i>N</i> = 63 Male 93.2%, Age distribution bimodal pattern, with peaks 45 and 75 years Female 6.8% Age range: 34–51 years, mainly married and Swiss nationals MARITAL STATUS: single 2.7%, married 89%, divorced 8.2% NATIONALITY: Switzerland 83.6%, rest of Europe 16.4% RELIGION: Protestants 34.2%, Catholics 38.4%, no religion 19.2%, Unknown (4.7%) EDUCATION: low level 23.3%, high level 75.4%, unknown 1.4% OCCUPATION: management and independent professions 21.9%, non-manual labor 8.2%, manual labor 27.4%, unemployed 37%, unknown 13.7%	<i>N</i> = 63 Male <i>n</i> = 3 Female <i>n</i> = 60 Age distribution in female victims showed a bimodal distribution peaks 40 and 75 years MARITAL STATUS: single 27.1%, married 68.2%, widowed 1.2%, divorced 3.5% NATIONALITY: Switzerland 87.1%, rest of Europe 12.9% RELIGION: protestants 34.2%, Catholics 38.4%, no religion 19.2%, unknown 4.7% EDUCATION: low level 23.3%, high level 75.4%, Unknown 1.4% OCCUPATION: management and independent professions 16.6%, non-manual labor 8.2%, manual labor 3.3%, unemployed 44.8%, unknown 3.5%	Suicide: firearm; hanging Homicide: firearm; strangulation; suffocation; stabbing
Reckdenwald 2016	USA 2003–2013, <i>N</i> = 1718 IP = 1073	NVDRS (national violent death reporting system) States of Alaska, California, Colorado, Georgia, Kentucky, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, North Carolina, Utah, Virginia, Wisconsin.	Not assessed	Males = 92%, 72% White (TOTAL) Males 94.87%, mean age 46.40 Race: 70.27% White (IP HS)	Females 73%, White 74% (TOTAL) Females 94.32%, mean age 43.48. Race: 73.72% White (IP HS)	Victim injury location: face 17.24%, head 56.48%, neck 15.00%, abdomen 13.79%, extremity 22.27%, chest 38.58%. (IP HS) mean number of wounds: 3.53, wounds to more than one body part 43.06% (IP HS) Firearms: 82.95% IP HS Method: Firearm 80.62% (handgun 78.73%, rifle 9.48%, shotgun 11.79%)(TOTAL)
Regoezi, 2016	USA (Cuyahoga County) Sweden 1991–2010 <i>N</i> = 176 HS IP = 116	Cuyahoga's county medical examiner's office (death certificate, autopsy, police reports) European Homicide Monitor (police reports, police investigations, court judgments, forensic psychiatric examination)	Inimate partner: (<i>N</i> = 41) 59.4% in US, (<i>N</i> = 75) 54.3% in Sweden, especially in case of divorce as a maladaptive stress reaction due to the interpersonal crisis History of domestic violence: 51.9% in US vs 10.5% in Sweden	Males 88.4% in Sweden and 94.5% in US Younger in US (50% of perpetrators in US were under the age of 40 compared to Sweden, one third) Presence of substances in 38.5% in US vs 30.4% in Sweden Presence of alcohol more likely in Sweden (25.9% vs 19.2% in US)	Females Age: in Sweden youngest (18 and under) and oldest (40–59 and 60 and over) while in US: half of victims 19–39 years old Substance: 84% of victims are not under the influence of substances compared to 69% in Cuyahoga County (not specific for IP)	Weapon: 96% firearms in US, the other with a knife or strangulation in Sweden 39% firearms, knives 18%, strangulation/suffocation 17.3% or other 25.9% (not specific for IP)

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Richards 2014	USA (North Carolina) 2002–2009 <i>N</i> = 83 (femicide-suicide)	North Carolina Coalition Against Domestic Violence (NCCADV) Access world news (electronic newspaper databank)	Evolution of domestic violence in 36% of HS	Higher percentage of perpetrators than victims are positive for substances and suffer of a mental disorder, often depression, before the event (30–40%) (not specific for IP) Male 100% Mean age 42 (19–80) Relationship: husband 46%, boyfriend 21%, ex-boyfriend 13%, ex-husband 10%, estranged husband 11%	Female 100% Mean age 39 (range: 18–84)	Gun 92%, knife/cutting instrument 6%, physical force/blunt trauma 1%, other 1%
Salari 2015	USA 1999–2005 <i>N</i> = 718	Internet searches engines and news link newspapers and television transcripts	Perpetrators' primary HI 48% Perpetrators' primary SI 27% Perpetrators' primary intention missing 25% Mercy killings 5% of events, more common among elders 8%	97% male relationship status: 39% estranged (leaving, divorced or ex-partner), breakups more common among young couples 51%, less common among elder adults 14% Psychotic episode or mental breakdown 3% Alcohol and drugs among perpetrators: 3%, (not primary motive but intensified a bad situation)	97% female	Firearms 88% (similar proportion by age group), non-gun related deaths include asphyxiation, stabbing, poisoning, bludgeoning.
Satoh 2016	Japan (Kanagawa Prefecture) 1999–2011 <i>N</i> = 76 HS IP = 28	Medico-legal autopsy	Motivation of suicide, confirmed in 40%: pain from sickness <i>N</i> = 9, psychiatric disorder <i>N</i> = 6 cases. Family problems <i>N</i> = 6, financial problems <i>N</i> = 4, couple relationship problems <i>N</i> = 2 Caregiver anxiety <i>N</i> = 2 Maternity anxiety 1. Suicide cause not found or unclear 57.9% (not specific for IP)	Marrried/unmarried couples (<i>N</i> = 24/ <i>N</i> = 4) 21 male (81%) 5 female (19%) Mean age of husbands: 66.8 ± 10.6 Mean age of wives: 63.5 ± 11.6 Mean age of male lovers: 37 ± 5 Mean age of female lovers: 25 ± 2 Relationship perpetrator-victim: 24 married couples 31.6% 2 couples unmarried 3% 2 miscellaneous relationship 3% Not other specification for miscellaneous relationship	39 men 43.3% 51 women 56.7% Mean age 35.4 years (not specific for IP HS)	Cause of perpetrator death: hanging 43% Cause of death for victims: strangulation 41.1% Same cause of death for perpetrator and victim for 72.4%, differs in 27.6% Suicide note in 42.1% cases
Siems 2017	Germany 1994–2014 <i>N</i> = 58 IP = 38 (13 cases of failed HS)	Forensic Database of the Institute of Legal Medicine and autopsies performed in the Institute of Legal Medicine (Frankfurt/Main)	66% intimate/marriage partner relationship (33 uxoricidal; 5 ex-partners) Main motives: financial problems (20%) and break-up conflict (19%)	Main gender: male (93%) Mean age: male = 57 years; female = 28 years Nationality: 60% German, 26% not specified, 15% other Profession: 49% retired; 20% unemployed; 30% employed Psychological disorders: 5 cases depression, 3 with	<i>N</i> = 74 Main gender: female (76%) Mean age: 42 years Nationality: 60% not specified, 35% German, 4% other Profession: 25% retired, 11% housewives, 53% employed Substance abuse: mean blood alcohol level 0.23‰, main	57% shooting was the method of choice for H and in 52% for S. 91% of the offenders who killed their victims by a gunshot, also committed suicide by shooting themselves. 71% at home 95% of the suicide occurred the same day of the

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Smucker 2018	USA (North Carolina) 2004–2013 <i>N</i> = 202 <i>IP</i> = 175	North Carolina Violent death reporting system (NC-VDRS) that includes secondary data from vital records, office of the chief medical examiner, state bureau of investigation, local law enforcement, crime laboratory reports	Not assessed	hallucinations, 2 previous suicide attempts Substance abuse: mean blood alcohol level = 0.41%; main drugs: benzodiazepines, cannabinoids, lamotrigine, propranolol 193 males, 9 females	drugs: antidepressants, benzodiazepines, cannabinoids Not assessed	homicide; in 3 cases it happened the next day. Males gunshot <i>N</i> = 175 Other weapon <i>N</i> = 18 females gunshot <i>N</i> = 8 other means <i>N</i> = 1 Higher risk to commit S after H if it is used a firearm (OR of 2.68) and if the perpetrator is married with the victim (OR 2.36, compared with other type of relationships)
Stump & Caman 2015	Sweden, 2007–2009 <i>N</i> = 8	National registers (ToxBase, Criminal Register; Patient Register) police files medico-legal autopsy records	Domestic HS <i>N</i> = 7; mercy killing-S <i>N</i> = 1	<i>N</i> = 8 males <i>N</i> = 1 retired, <i>N</i> = 1 employed, <i>N</i> = 6 not specified. Psychiatric history <i>N</i> = 5 (dependency disorder + anxiety disorder <i>N</i> = 1; substance use disorder <i>N</i> = 1; major depression <i>N</i> = 2; maladaptive stress disorder <i>N</i> = 1). Previous conviction <i>N</i> = 1. Previous S attempt/threats (S/H) <i>N</i> = 5. Intoxicated <i>N</i> = 3 (alcohol, amphetamine and alcohol, cannabis and alcohol); sober <i>N</i> = 1; not specified <i>N</i> = 4.	Females <i>N</i> = 8 Spouse <i>N</i> = 3, ex-spouse <i>N</i> = 5 Intoxicated (alcohol) <i>N</i> = 1.	H: sharp violence <i>N</i> = 2; sharp and blunt violence <i>N</i> = 1; strangulation <i>N</i> = 1; shooting <i>N</i> = 4 (licensed weapon <i>N</i> = 3, non-licensed weapon <i>N</i> = 1). S: sharp violence <i>N</i> = 1; hanging <i>N</i> = 1; drowning <i>N</i> = 1; shooting <i>N</i> = 5 (licensed weapon <i>N</i> = 4, non-licensed weapon <i>N</i> = 1.
Verzeletti 2014	Italy 1987–2012 <i>N</i> = 19 <i>IP</i> = 18	Brescia Institute of Forensic Medicine (Brescia/Italy)	All the victims were related to their perpetrators by an intimate binding (45% wife, 20% ex-girlfriend, 15% girlfriend, 10% daughter, 10% lovers). 32%: end of the relationship 21%: old couples with significant illness 21%: morbid jealousy 21%: no information 5%: fear to lose the entrusting of the daughter	Main gender: male (100%) Mean age: 42 years Nationality: 95% Italian, 5% (1 case) Romanian. Profession: most workers in activity; 25% retired. Psychological disorders: No information was available regarding perpetrator's mental illness, except for one case, suffering from depression. Substance abuse: Alcohol was detected in 2 perpetrators, while cocaine in 1 murderer.	<i>N</i> = 20 Main gender: female (100%) Mean age: 37 years Nationality: 95% Italian, 5% (1 case) Romanian. Employment status: most workers in activity; 25% retired. Substance abuse: Alcohol was detected in 1 victim, also cocaine in only 1 victim.	Mainly firearms for 68% H and 84% S. Other methods for H: asphyxial means, stabbing. Other methods for S: cut the throat, hanging, CO intoxication. The same weapon was used both for murder and suicide in 14 events (74%). Mostly occurred at home. Perpetrators committed S just after the H; only 1 S occurred the day after the H.

Table 1 (continued)

Author, Year	Country, period assessed, <i>N</i>	Source	Motives	Perpetrators' features	Victims' features	Method for HS
Weeke 2017	Germany 1996–2005 <i>N</i> = 29 IP <i>N</i> = 29	Archives of the largest national news agency and many regional newspapers	Not specified	Gender: males (88.8%) Mean age: 46.8	Gender: female Mean age: not specified	Not specified

*IP = intimate partner HS

study compared elderly and young couples: mercy killings were more common in the first and breakup-related HS in the latter; moreover, elderly perpetrators showed a greater frequency of suicidal ideation, while homicidal ideation was more frequent in younger ones. Suicidal ideation in the elderly was related not only to mental or physical health problems and caregiver burden but also to financial problems and debts. In 25% of cases, a primary homicidal or suicidal intent was not reported. Shooting was the most commonly used method (88%).

The study by Bridges [32] compared two groups between 1968 and 1975, one of 400 elderly H victims and one of 184 elderly HS, the latter including 122 intimate partner HS. The authors report that 81% of victims were elderly females, albeit specific information was unavailable either for perpetrators' features or motives for the cases of elderly HS. One or both partners of a long-living marriage having multiple health problems was identified as risk factor for HS, likely suggesting mercy killing/altruistic suicide, with shooting as the most common method (81.8%).

Smucker [38] reported about 202 HS cases in North Carolina from 2004 to 2013, but this study did not provide details either about motives leading to HS or about victims' features. Information about perpetrators was limited to gender (*N* = 193 males, *N* = 9 females). Method for HS was shooting in most cases, and a higher risk to commit suicide after homicide was described in those cases when a firearm was used (OR = 2.68) or the perpetrator was married to the victim (OR = 2.36, compared with other types of relationships).

Burgess [33] described 165 HS cases from 2001 to 2011. More than half of perpetrators were males, while most victims were females and younger than their partners. A minority of perpetrators had a history of convictions, either drug- and alcohol-related or due to violent offense. The main reasons for HS were domestic conflict and consortial, related to physical ailing. Ethnic differences were found regarding methods for HS, with gunshot and blunt force trauma being more frequent among Caucasians perpetrators and cutting instrument injuries being more common in African American, Hispanic, and Asian perpetrators.

In the Richards study [35], 36% of the 83 HS cases assessed from 2002 to 2009 were the evolution of a history of domestic violence; shooting was the method used in 92% of cases. Only few details were described for perpetrators and victims (e.g., relationship between perpetrator and victim, age).

Manning [15] focused on educational level in a sample of 20 HS from 2005 to 2008 and argued that the proportion of H ending with an S was greater when the perpetrator was less educated than the victim, while S was least likely to happen when the perpetrator was more educated than the victim. In the Manning study, all perpetrators were male, and all victims were female; loss of intimacy was the main reason for HS, and shooting was the most common method for HS.

Oliffe [34] described 7 HS cases reported by newspaper articles from 1987 to 2013. All perpetrators were male, and all victims were female. Reasons included financial stress in 6 cases out of 7; mental and physical health and relationship stress were also mentioned as motives for HS. Shooting was the most common method both for H and S (4/7 cases).

European studies

Cengija [39] described 17 HS cases in Croatia from 1986 to 2009, 76% of which were spousal/consortial. This study did not discriminate between HS subtypes. Overall, most perpetrators were males (82%) (only two females killed their spouses), and most victims were females (74%), all belonging to a low socioeconomic class. Amorous jealousy was the most common cause of these events (35%), and firearm was the most common method both for H (50%) and S (65%).

The De Koning study [1], performed in Belgium, included 47 HS cases from 1935 to 2010 and grouped according to offenders' and victims' age (less or more than 55 years). While no significant difference was found between the two groups of "young" and "old" offenders and victims regarding gender (most perpetrators were male and most victims female), differences emerged in motive for HS, being mostly amorous jealousy in offenders aged less than 55 and mercy killing/altruistic suicide in most cases of offenders aged more than 55 years. Differences were found in method as well: it was usually shooting both for victim and perpetrator in couples aged less than 55 and shooting for the victim but asphyxia for the perpetrator in those aged more than 55 years.

A different approach of subgrouping HS was adopted by Gregory [40] in the UK. The 22 HS cases recorded in the period 1993–2007 were subdivided according to the presence/absence of a history of domestic abuse. Most perpetrators were male, except for one female in the group with a history of domestic abuse, and all victims were female in the group with no known history of domestic abuse. The main reason underlying HS was jealousy or the partner attempting to leave the relationship in both subgroups. No predominant method for H and S was identified.

Nearly two thirds of the 60 HS cases included in the Flynn study [41], performed in England and Wales in the period 2006–2008, were intimate partner HS involving current or former spouse or partner. This study reported detailed information also about perpetrators' previous history of domestic violence, self-harming behaviors (including suicide attempts), and bereavement by suicide; moreover, it described prevalence of mental health disorder diagnosis or previous contact with mental health services. Classification of HS offenders discriminated between those with a history of depression and those with a history of domestic violence. Main motives for HS were described as falling in one of the following two categories: loss of a close personal relationship either through

imminent separation or divorce and a significant change in the relationship due to victim's health conditions (e.g., dementia). Overall, most offenders were middle-aged males; 56 were registered with a general practitioner practice, and suicidal ideation was noted by a general practitioner in 7 cases. The majority had no previous contact with mental health services.

Panczak [22] studied 63 intimate partner HS out of 73 total cases of HS in Switzerland in the period from 1990 to 2008. This study described detailed information about perpetrators (mostly males) and victims (including not only gender, age, marital and occupational status but also nationality, residence status, religion, education, living conditions, number of persons per room, language, urbanization), but did not discriminate among HS subtypes and did not assess motives for HS. Regarding the method, shooting was the most common one for both H and S.

Two studies were performed in Germany [42, 43]. The first, by Siems [42], involved 58 HS, including 13 cases of failed HS from 1994 to 2014. Sixty-six percent of these cases were intimate partner HS involving married couples ($N = 33$) or ex-partners ($N = 5$). Considering all the events, the main motives reported were financial problems and breakup conflicts. Most perpetrators were males (93%), and most victims were females (76%). Shooting was the method for 57% of H and 52% of S. In 95% of cases, H and S occurred on the same day. The Weeke study [43] reported about 288 events, of which only 29 H and S acts were completed. Only familial HS cases were considered, where perpetrator killed family members or intimate current or former partners from 1996 to 2005. Most offenders were males ($N = 256$). This study specifically assessed suicide notes, reporting that 40% of males committing uxoricides left suicide notes, while only 28.6% of female offenders did so. Uxoricide-suicide perpetrators who wrote notes often had underage children and seemed to feel a greater urge to explain their acts.

The study by Verzeletti [44] included 19 HS in Brescia (Italy) from 1987 to 2012. All the victims were females, related to their male perpetrators by an intimate binding (wife, girlfriend, ex-girlfriend, lover, daughter), which was an intimate partner relationship in 18 cases. Overall, 6/19 events were related to the breakup of a relationship and 4/10 to morbid jealousy, while 4/19 happened in couples with one partner suffering of a severe illness. Both perpetrators and victims had a low educational level. Method was shooting in most cases, both for H (13/19) and S (16/19). Perpetrators committed S just after the H in all the events except one, in which S occurred the day after the H.

The Sturup and Caman study [45] included 8 intimate partner HS cases out of a total of 13 HS cases recorded in Sweden in the period from 2007 to 2009. The authors described HS type according to the models proposed by Liem (2010) and Harper and Voigt (2007) [21, 30], respectively. According to the first, they classified these 8 cases as intimate partner HS,

with one further described as intimate partner HS related to declining health. According to the latter model, they classified 7 cases as domestic HS and one as mercy killing-suicide. All perpetrators were males while all victims were females; shooting was the main method both for H and S.

Balica [46] reported about 83 HS cases in Romania in the period 2002–2013; 69% of these were classified as intimate partner HS. The Balica study did not describe HS methods but had a specific focus on the effect of emigration: intimate partner HS were significantly more frequent in the emigrant than in the non-emigrant sample ($p < 0.04$). Overall, most perpetrators were males, with a low occupational status in 48.3% of cases, while victims were mainly females. Reasons underlying HS included end of relationship/divorce, jealousy, suspicion of unfaithfulness/infidelity, and financial difficulties.

Comparison USA/Sweden

The study by Regoeczi [47] compared 176 cases, including all types of HS in the USA and Sweden; intimate partner HS were 59.4% of cases in the USA and 54.3% of cases in Sweden. The main motive for intimate partner HS was a maladaptive stress reaction in cases of divorce or interpersonal crisis. Perpetrators in both countries were mostly males, while victims were mostly females. Differences between the two countries were found in methods for HS (shooting in 95% of cases in the USA and 39% of cases in Sweden) and in history of domestic violence, which was reported in 51.9% of cases in the USA and in 10.5% of HS cases in Sweden.

Other countries

Satoh [48] reported about 76 HS cases in Japan from 1999 to 2011, including all types of HS. Details about intimate partner HS were not specified in this study. The mixed nature of the sample and the fact that in 63.2% of cases the perpetrator/victim relationship was a parent/children one, explain why perpetrators were males in 49.3% of cases and females in the remaining 50.7%. Motives for HS were reported only in 40% of the cases. The most frequent method for HS in the total sample was asphyxia, via hanging for S (43%) and strangulation for H (41.1%). Suicide notes were left in 42.1% of cases.

The Densley study [49] was performed in China about 63 total cases of HS from 2000 to 2014, 38% of which were motivated by intimate partner conflict and 12.5% by extramarital affair. Intimate partner violence was the most prevalent risk factor for HS. Most perpetrators were male and most victims were female. In most H cases, the weapon used was a knife, while methods for S were highly variable, including use of a knife, drug, or poison in more than half of cases.

In Ghana, Adinkrah [50] described 36 intimate partner HS out of a total of 50 cases of HS from 1990 to 2009. Main reasons included sexual jealousy, partner being sexually unfaithful, infidelity, end of the relationships and quarrels, but neither number of cases nor percentages were specified. Perpetrators were males in 97.2%, and victims were females in 97.2%. The method for HS was in most cases the use of a firearm, both for H (62.9%) and S (51.4%).

Discussion

The number of available studies about the topic of intimate partner HS is scant, and their heterogeneity makes it difficult to generalize or compare results. Most studies reported data about mixed HS samples including different types of HS and not specifically focused on the intimate partner subtype, making it hard or impossible to disentangle the features of each HS subtype. Moreover, another relevant problem with studies in the HS field is that they do not report the same type of data; therefore, the information we decided to extract from the available studies (see Methods) was often missing about several variables.

Countries and Sample Size

Most studies were performed in European countries (10/22, 46%) (Germany, $N=2$, UK $N=2$, Italy $N=1$, Switzerland $N=1$, Belgium $N=1$, Croatia $N=1$, Romania $N=1$, Sweden $N=1$) [1, 22, 39–46] and in the USA (8/22, 36%) [15, 32, 33, 34, 35, 36, 37, 38]. One study was a comparative analysis involving both the USA and Sweden (1/22, 4.5%) [47]. One of the selected studies was conducted in China (1/22, 4.5%) [49], one in Japan (1/22, 4.5%) [48], and one in Ghana (1/22, 4.5%) [50].

Overall, the studies included in this mini-review assessed nearly 3900 HS cases, with almost 2700 involving an intimate partner (about 70%).

Period Assessed

The time period assessed by the studies highly varied, spanning from a minimum of 2 years [41, 45] to a maximum of 75 years [1]. The oldest data available were from 1935 in the De Koning's study [1], while the most recent ones were from 2014 [42].

Type of Study and Data Source

All studies were retrospective. Panczak's study was described as a cohort study, but actually HS-related information was retrospectively assessed [22]. We found one newspaper article

review [34•]; one comparative analysis [47], one short report [44], and two case series [41, 45].

Most of the studies took information from multiple sources (41%). Overall, sources most frequently used were medical examiners records/forensic or legal medicine archives (13/22, 59%) [1, 15, 33, 37–41, 42•, 44, 45, 47, 48] and newspapers/online archives (9/22, 41%) [1, 34•, 35, 36••, 39, 43, 46, 49, 50]; followed by public security (police, FBI, etc.) reports and court judgment records (7/22, 32%) [32, 38, 39, 41, 46, 47, 49]. Specific datasets on domestic violence were used only in two out of 22 studies (1%) [15, 35], and only a couple of studies retrieved information from statistic institutes or census data (2/22, 1%) [22, 39].

Studies relied on information retrieved from different sources, some of which are available only in specific countries (for instance datasets on domestic violence, or census data). In several countries, for example Romania [46], there is no standardized reporting system for HS, so newspapers and online archives become the main sources for data in these cases.

HS Rate

HS rate was reported by nearly a half of the studies (10/22, 45%) [22, 39–41, 44–48, 50]. See Table 2 for more details.

The HS rate was quite variable, ranging from 0.01 per 100,000 persons per year in Ghana [50] to 0.2 per 100,000 in Croatia and Cuyahoga County [46, 47]. The literature reports a relatively high HS rate in the USA, ranging from 0.27 per year in Kentucky to 0.38 per 100,000 persons per year in central Virginia [7, 51].

Perpetrators' and Victims' Features

Different studies showed highly various information about perpetrators and victims. Some papers limited the description to gender and age: 21/22 studies (95%) described a consistently higher prevalence of male offenders, and 20/22 studies (90%) reported a prevalence of females among victims. Perpetrators' age was reported by 19/22 studies (86%), while victims' age by 18/22 studies (82%). Some studies offered more detailed information, including race/ethnicity (6/22, 27%) [15, 32, 33, 37, 40, 41]; marital status or victim-perpetrator relationship (19/22, 86%) [15, 22, 32, 33, 34•, 35, 36••, 37, 39–41, 42•, 44–46, 48–50]; socio-economic and employment status (10/22, 45%) [22, 33, 39–41, 42•, 44–46, 50]; educational level (4/22, 18%) [15, 22, 39, 46]; autopsy findings (3/22, 14%) [37, 42•, 44]; including toxicology; alcohol/drug consumption (11/22, 50%) [1, 33, 36••, 39–41, 42•, 44–47]; health status and medical history, including psychiatric symptoms/diagnosis/treatment and previous suicide attempts (12/22, 54%) [1, 33, 36••, 39–41, 42•, 43–47]; history of domestic abuse (7/22, 32%) [15, 33, 35, 40, 41, 46, 47], and previous criminal history (2/22, 9%) [33, 40].

The main results emerging from the current mini-review are consistent with previous reports about intimate partner HS, suggesting that intimate partner HS are predominantly committed by men, usually married, cohabiting or recently separated from their partner, with a medium or low employment status, while the victim is usually the female current or former partner [2]. An association between HS and socially disadvantaged conditions, unemployment, educational level,

Table 2 HS rate

Author	Country	Period	HS rate
Sturup, 2015	Sweden	2007–2009 (2 years)	0.05 per 100,000 inhabitants (HS victims represented 5.5% of all Swedish homicides victims)
Adinkrah, 2014	Ghana	1990–2009 (19 years)	0.01 per 100,000 inhabitants per year over the 20-year period (approximately 2.5 HS incidents per year)
Balica, 2016	Romania	2002–2013 (11 years)	0.07 per 100,000 inhabitants (range = 0.005–0.146)
Flynn, 2016	UK	2006–2008 (2 years)	0.05 per 100,000 inhabitants per year
Gregory, 2012	UK	1993–2007 (14 years)	2.0 incidents per year (comprising 3.1% of all homicides in the region)
Panczak, 2013	Switzerland	1990–2008 (18 years)	0.09–0.10 per 100,000 inhabitants; victimization rates 0.13 and 0.15 in 1991 and 2001, respectively. The incidence was 3 events per million households and year
Verzeletti, 2014	Italy	1987–2012 (25 years)	0.06 events per 100,000 inhabitants per year (Brescia)
Cengija, 2012	Croatia	1986–2009 (23 years)	0.2 per 100,000 persons per year (annual rate = 0.71)
Regoczi, 2016	Sweden, USA	1991–2010 (19 years)	0.07 per 100,000 inhabitants in Sweden 0.20 in Cuyahoga County
Satoh, 2016	Japan	1999–2011 (12 years)	5.8 cases of HS per year (Kanagawa)

The table summarizes for each study the HS rate for the Country considered in the selected period

and legal problems/previous convictions has been suggested by all but one author [37].

Mental illness has sometimes been reported in offenders, with depression as the most commonly cited disorder [26, 52]. The Sturup and Caman's study, which is one of the 11/22 studies (50%) reporting details about contact with mental health services and psychiatric morbidity [1, 36•, 39–41, 42•, 44, 46–48], offered an interesting perspective about this issue, suggesting that it was not necessarily a risk factor for HS. In fact, only few HS cases were perpetrated by people affected by a diagnosed mental disorder.

Motives for HS

Based on motives for HS, some studies adopted exclusion criteria: for instance, Manning and coworkers (2014) limited their analysis to HS cases that were rooted in conflict or hostility, counting cases in which the killing followed an argument, separation, or divorce; in which the killer had recently threatened or complained about the victim; and in which suicide notes suggested that the killer was angry with the victim [15]. Other studies included all intimate partner HS and then subdivided them according to the reasons underlying the behavior. Finally, in some studies, data about motives were not specified (5/22, 23%) [22, 35, 37, 38, 43].

Two main intimate partner HS categories have been suggested in the literature: the first is focused on a pathological type of possessiveness or jealousy, usually occurring in HS with perpetrators or victims aged 55 years or less, whereas the latter usually involves an elderly couple with at least one severely ill partner ("mercy killing"), with offender and victim aged more than 55 years [4, 10]. Briefly, these can be described as amorous jealousy/domestic conflict and mercy killing/altruistic suicide. Ten out of 22 studies (45%) reported only jealousy/domestic conflict as motive for HS [15, 39–41, 42•, 45–47, 49, 50], while 7/22 (32%) reported both Marzuk's motives [1, 32, 33, 34•, 36•, 44, 48].

Some studies also focused on other trigger factors for HS, such as social stressors and financial difficulties [1, 33, 34•, 36•, 42•, 46, 48]. The role of mental health is debated: some papers suggested a relationship between mental health status and HS [34•, 39, 46, 48], while others described mental health status as an influencing factor [41]. Mental health problems observed in HS events were depression and substance/alcohol abuse in most cases [34•, 47].

Timing

The high variability in time elapsed between H and S is a shared feature of the overall HS literature, and currently

there seems to be no specific relation between differences in time elapsed between H and S and perpetrator's and victim's profile or motives leading to the HS event. Some researchers rely on a time span of 24 h [24] or several days [5], between the H and the S of the perpetrator; others use a week as an inclusion criterion [5] and still others do not use a timeline at all [12].

In the present review, time between H and S was analyzed in 14 studies (63%). Studies that chose 24-h time frame as a maximum to define the event as HS were 23% [1, 15, 37, 43, 47]; in 41%, the cutoff was longer [22, 39–41, 42•, 44, 46, 49, 50]; in most cases, 1 week as a maximum value, even if the suicidal events almost always occurred in the first 24 h. Finally, in 32% of the studies, this information was not specified [32, 33, 34•, 35, 36•, 38, 48].

Prior Threat to Kill

Information about prior threat to kill the victim was not specified in nearly a half of the studies assessed (9/22, 41%) [1, 22, 32, 34•, 37–39, 44, 48]. Seven studies (7/22, 32%) reported prior threats to kill: these were described but not specifically quantified by Burgess (2015) and Adinkrah (2014), while Balica (2016) and Manning (2014) gave more information about number of cases with prior threats (respectively, two cases of prior death threats and one case in which the perpetrator threatened S before committing the H; eight cases, 40% of the sample) [15, 33, 46, 50]. Siems (2017) specified how 24% of the offenders announced their plan prior to the event (farewell letter or announcement by telephone call; call to the ambulance service or police after the H) [42•]. Weeke (2017) reported an evidence of planning in 59% of cases in which the perpetrator left a suicide note. In some studies, prior threat to kill was not assessed, but it was reported the association between HS and previous domestic violence (7/22, 32%) [43]. Gregory (2012) mentioned one case out of 12 of domestic abuse where there was a prior threat to kill the victim [40]. Regoeczi and coworkers (2016) reported only a history of previous domestic violence [47], as Richards and coworkers (2014) who described that in 36% of the cases HS was the evolution of domestic violence [35]. Previous episodes of domestic violence were reported by Manning (2014), Burgess (2015), and Flynn (2016; for 39% of the offenders) [15, 33, 41]. In Salari (2015), threats to victim and prior history of domestic violence were found, in particular among young and middle-aged couples in which perpetrators had primary homicidal intention (48% of cases) [36•].

Suicide Notes

Information about suicide notes was available for about half of the studies (10/22, 45%) [1, 15, 33, 34•, 36•, 39, 40, 42•, 43,

48]. Interestingly, the study reporting the higher percentage of suicide notes left by the perpetrator was the one performed in Japan by Satoh (2016), where suicide notes were left in 42.1% of cases [48]. Weeke et al. (2017) specifically focused on the comparison between suicide notes writers and no-writers of suicide notes; but consistently with the literature, they failed to find any specific difference between the two groups [43]. Overall, the results suggest that the most significant predicting factor for writing suicide notes is having an underage children; no difference has been found between male and female offenders [43].

Method for HS

The current mini-review is consistent with the existing literature in reporting shooting as the most common method for HS [3, 26, 53–58]. In 16/22 (73%) of the selected studies, perpetrators used firearms [1, 15, 22, 32, 33, 34, 35, 36, 37–39, 42, 44, 45, 47, 50]. Other studies reported different methods for HS, which were in most cases stabbing, in 4/22 cases (18%) [41, 43, 46, 49] and asphyxia in 2/22 cases (9%) [40, 48].

Focusing on differences between countries, shooting was the main method in the USA (100%); while in other Countries, especially Japan and China [48, 49], other methods were more common (asphyxia and stabbing, respectively). In Europe, the use of firearms was the most common method (63%), but in 27% of studies, different methods were used [40, 41, 43, 46].

Although most studies reported that the same weapon was used to perform both H and S, some did not, for example Flynn (2016; sharp instruments for H and hanging for S) follows: [41], and Verzeletti (2014; the murderer shot or hanged himself after having stabbed or strangled his wife) [44].

An important factor that might partly explain the different gunshot prevalence as HS method is the deep difference in the worldwide accessibility to guns, related to different gun laws. For example, in the USA, firearms are more commonly legally owned by the population; while in most European countries, the access to guns is restricted [1, 41, 46, 47].

Conclusions

Despite the discrepancies and inconsistencies emerging from the above description, some shared features in the intimate partner HS studies can be identified. Notwithstanding the limited number of studies included in this mini-review, it emerges the need of a shared and common language to describe the motives and reasons for HS, for which relevant classification suggestions have already been proposed.

The association between domestic violence and HS, which is quite consistently reported across different studies, suggests the need to develop prevention strategies targeting this at risk population. The role of substance/alcohol abuse on behalf of

perpetrators should be investigated with more detail as a possible trigger of HS events, as it could be a further target for prevention strategies.

Regarding the main methods used for both H and S, suggestions have been raised about firearms regulation being one relevant factor possibly affecting the HS phenomenon [2, 58].

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

Appendix 1. Search Strings

Pubmed:

- (“Homicide”[Mesh] AND “Suicide”[Mesh]) AND “Intimate Partner Violence”[Mesh] AND (“loattrfull text”[sb] AND (“2012/01/01”[PDAT]: “3000/12/31”[PDAT]) AND “humans”[MeSH Terms])

- ((“homicide”[MeSH Terms] OR “homicide”[All Fields]) AND (“suicide”[MeSH Terms] OR “suicide”[All Fields])) AND “intimate partner violence”[All Fields] AND (“loattrfull text”[sb] AND (“2012/01/01”[PDAT]: “3000/12/31”[PDAT]) AND “humans”[MeSH Terms])

Scopus:

- (TITLE-ABS-KEY (homicide) AND TITLE-ABS-KEY (suicide) AND TITLE-ABS-KEY (intimate AND partner AND violence)) AND PUBYEAR >2011

- (TITLE-ABS-KEY (homicide) AND TITLE-ABS-KEY (suicide) AND TITLE-ABS-KEY (partner)) AND PUBYEAR >2011

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- Of importance
- Of major importance

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