Analysis of murder rates in Sweden, comparing gender, age, and cause of death between 2003 and 2017

Jenks, Emma

UNIVERSITY OF SPLIT
SCHOOL OF MEDICINE

Emma Jenks

ANALYSIS OF MURDER RATES IN SWEDEN, COMPARING GENDER, AGE, AND CAUSE OF DEATH BETWEEN 2003 AND 2017

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Kristijan Bečić, MD, PhD

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1. INTRODUCTION

1.1. Definition of Homicide

Homicide is the killing of a person by another with the intent to cause death or serious injury, by any means. This excludes death by legal interventions or operations of war (1). There are many types of killing but not all of them are considered intentional or unlawful. Within the large scale of violent deaths, the key element of intentional homicide is the complete responsibility of the perpetrator, thus excluding killings related to war, legal interventions, self-inflicted deaths (suicide), justifiable killings such as self-defense and deaths caused by recklessness or negligence but not intentional killing (2).

1.2. Epidemiology

1.2.1. Global Incidence of Homicide

In 2012 UNODC estimated that death as the result of homicide amounted to a total of 437.000 (global rate 6.2 per 100 000) worldwide. In 2015 an estimated 470 000 people fell victim to homicide globally according to WHO, (global rate of 6.4 per 100 000). With the Region of Americas (WHO region) accounting for more than a third of those deaths (36%) followed by Africa (31%) and Asia (28%), while Europe (5%) and Oceania (Australia, New Zealand, Melanesia, Micronesia, Polynesia) (0.3%) have the lowest rates of homicide at regional level. Europe and Oceania have since 1990 experienced a continued decrease in homicide rates, while other regions like the Americas where homicide has been high, have seen cases of increase. Between 2010 and 2012 the number of homicide victims decreased by 11-14 percent in Europe and Oceania, while The Americas saw an increase of 8.5 percent (3).

1.2.2. Murders in Sweden

Murder, manslaughter and assault with a fatal outcome are collectively called lethal violence. In 2018, 108 cases of lethal violence were reported in Sweden. This is a decrease of 5 cases, compared to 2017. Since 2002, the number of confirmed cases of lethal violence has varied between 62 and 113 cases per year. Up until 2014, the number of lethal violence cases was marked by an overall descending trend with relatively large variations from year to year.

But in the last three years (2015-2017), the number of cases has remained at a higher level than previous years, breaking the decreasing trend.

In 2018, the victim was a woman in 33 cases (31%) and a man in 75 cases (69%). When comparing with 2017, the fraction of women increased by 7%, while it decreased by 7% for men. In regards to the entire population, the number of confirmed cases of lethal violence was 1.06 cases per 100.000 inhabitants in 2018, a lower level than in 2017 (1.12). The number of women increased from 0.54 to 0.65, whilst the number of men decreased from 1.70 to 1.47 (number of victims per 100.000 inhabitants).

The majority (70%) of the confirmed cases of lethal violence in 2018 were reported in one of the major metropolitan regions of Stockholm. This level has fluctuated between 68 to 75 percent during the years 2010-2017 (4).

1.3. Risk Factors for Homicide

Knowledge of why homicides happen is essential from a policy perspective, as without such knowledge it is very difficult to apply appropriate strategies for prevention and reduction of homicide. This is an easy concept to understand but to catalog these grounds is difficult because the reason why behind a homicide can be numerous.

1.3.1. Homicides Related to other Criminal Activities

There are two distinct groups of homicide that are connected with other crimes: those committed by organized criminal groups, and those committed while perpetrating more conventional criminal acts, like a robbery. In these cases, homicide is not necessarily the main goal but committed in relation to other criminal activities to achieve the original goal of unlawful profits or to avoid exposure. Organised criminal groups main goal is to generate illicit profit but they may commit homicide for many other reasons, such as eliminating the competition or stating territorial control (2).

1.3.2. Demographical Risk Factors

In societies where young people, especially young males, comprise a greater portion of the population, homicide rates tend to be higher. Shifts in political government may also be associated with an increased homicide rate. The fall of Communism in Eastern Europe, apartheid in South Africa, and dictatorship in Brazil all saw a swift increase in homicide rates.

Homicide rates are likely to rise in the lack of good governance and successful regulation of law. Homicide rates tend to be lower where states have authority in the eyes of the general public, can deliver righteous justice based on the rule of law, and have low levels of corruption (1).

1.3.3. Socioeconomic Inequalities in Homicide

Poverty and economic inequality is a clear risk factor for violence. According to the World Health Organization's European Region 65.000 people died as a result of interpersonal violence in 2004, with over 90% of these deaths occurring within low- and middle-income countries. A study from 2012 showed that educational inequalities in homicide were present in all 12 European countries of the study. At the individual level, greater education helps advance the ability to reason and exert effective problem solving. This concurrence with the fact that males from lower socioeconomic positions are more prone to argumentative behavior and that many homicides occur between people who have similar characteristics and live in similar social settings, often in the context of male-on-male (alcohol-fueled) arguments. In such situations the knife is often the 85% weapon of choice and the propensity to carry a knife has been related to low education.

Apart from individual characteristics, other social structural and/or cultural factors might also be affecting the occurrence of homicide in different educational groups. For example, the removal of social support networks, growing inequality along with an increase in lethal violence associated with organized crime may all underlie the high levels of homicide in a country or even a smaller region like a neighbourhood, where absolute inequalities are high. In contrast to the low homicide rates in for example the Scandinavian countries, where the lower levels of social and economic inequality may be reflected in their lower homicide rates (5).

1.3.4. Alcohol

Education and its social status it endorses, is also associated with different patterns of alcohol consumption. This is significant because alcohol consumption has been associated with homicide at both the individual and collective levels. Although alcohol plays considerable part in a large amount of violence throughout Europe, the connection is stronger in northern and Eastern Europe marked by heavy drinking occasions and a more 'explosive' drinking pattern when compared to western or southern Europe. This implies that the effect of alcohol in regards to lethal violence may be noticeably different in terms of inequalities in homicide in countries with different drinking cultures (6).

Two different models explain the connection between alcohol and aggression. One is the pharmacological dis-inhibition model that puts forward that alcohol intoxication influences the area of the brain responsible for impulse control and therefore alcohol-impaired individuals are likely to behave impulsively or aggressively (7). The expectancy model of alcohol-induced aggression suggests that the known notions concerning alcohol, and that it is the cause of aggressive behavior, may in turn cause an aggressive action among perpetrators of violence (8). On top of this, there is also evidence that alcohol consumption may contribute to victimization by increasing vulnerability. Across 61 independent studies conducted in 16 countries, an average of 48% of homicide victims tested positive for alcohol (9).

1.4. Forensic Pathology

1.4.1. Principles of investigation

A forensic pathology examination is not only the act of an autopsy and finding a cause and manner of death. It is a series of steps that will help conclude an entire investigation, whether it be an accident, suicide or in our case a homicide.

Interpretations and conclusions by the examiner must be based on sound medical principles and a realistic explanation of events. Failure to follow these principles may result in wrongful convictions and charges for the forensic pathologist.

The first step in logical forensic investigation is documentation. Photographic documentation of the scene and body untouched prior to removal, visualizing injuries separately and its orientation and relationship to the entire body, with necessary measurements. Describing the

scene and surroundings are of great importance for a full understanding of the circumstances before an autopsy can be performed. This also includes witness statements, any past historical information including medical, psychiatric and family history. Anything that may be significant for the investigation, for example knowledge concerning if any resuscitation on scene occurred. All aspects that may need some background to make an objective and most accurate conclusion further on in the investigation (10).

1.4.2 Autopsy report

A forensic autopsy is a post-mortem examination that addresses medico-legal objectives. A forensic autopsy is also called medico-legal autopsy. The performance of a forensic autopsy follows directions from the concerned legal authority regarding sudden, unexpected, suspicious or otherwise criminal deaths.

The objectives of a forensic autopsy may often differ from one case to another and may be specific for a particular case. However, in general, the following are the objectives carried out in a forensic autopsy:

- To determine the identity of the dead
- To establish the cause of death
- To assist in confirming or disproving the alleged manner of death, wherever possible
- To estimate the time since death (post-mortem interval)

The importance of identifying the dead speaks for itself. The cause of death is either an injury in cases of violent deaths or disease in cases of natural deaths. The approach or method in how the cause of death came to happen is considered the manner of death, which is either natural or unnatural. For instance, if a head injury is the cause of death, then how the injury occurred can be accidental, suicidal or homicidal. The demising head injury could have resulted from an accidental fall from a height, a suicidal jump from the top of a building, or a deliberate push, in which case the manner of death is deemed homicidal (11).

1.5. Classification of Injury

1.5.1. Blunt Force Injury

Injuries caused by blunt force are seen regularly in daily forensic casework and at times especially when there are fewer details surrounding the event of circumstances, it might become difficult to figure out the cause and background of injuries, be it an accident, criminal violence or self-infliction (12).

In Germany, homicides and bodily harm ending in death are most frequently caused by blunt force injuries (13). An Indian study showed that people older than 60 years are five times more often victims of blunt than of sharp force (14).
It is a constant challenge in forensic medicine to distinguish whether an injury by blunt force is caused by an accident, self-infliction or crime. It can become even more difficult to distinguish between accident and crime if there are no witnesses or if the witness/person is not able to make a statement, for example children, people with poor memory, and those who died (12).

The three main outcomes and descriptions of blunt force injuries are abrasions, contusions, and lacerations, each of which is created in response to the direct exertion of force to the body. This being said, it is important to not forget that there is wide variation in the amount of force needed to create an injury and that the external appearance of some wounds may either excessively over or underestimate the force of an impact. Therefore, it is important to examine, document, and think about the significance of underlying soft tissue, bony, vascular, and visceral injury. It is also important to take into account circumstantial data before interpretation of findings are made (10).

1.5.1.1. Abrasion

An abrasion occurs when the skin contacts an opposing surface and the movement of either the skin or the surface results in friction that pulls away the superficial layers of skin. Injuries, which have no potential in themselves to cause death, may have evidentiary value at some later point. Subtle patterns in abrasion morphology can be of great supportive value during the investigation of a death, for example on a man who had allegedly been stomped to death, you might find an abrasion resembling the sole of a shoe (10).

1.5.1.2. Contusion

Contusion is another term for bruise, it occurs when a blunt impact tears capillaries and blood vessels, causing blood to escape into the extravascular space. They can be differentiated from livor mortis by how livor involves the settling of blood to dependent portions of the vascular system, not the surrounding tissues and of such when incised will not appear haemorrhagic unlike contusions (10).

1.5.1.3. Laceration

A laceration is formed when an object impacts the body with a force that surpasses the elastic capacity of the skin and underlying tissues, causing a *forceful tearing* of the skin. This term has a considerable distinction from the public's generalization of the word including any variants of cuts or tears of the skin and it is important to distinguish the difference between them. Unlike the incisive and sharp edges found from a sharp force injury, the margins of a laceration tend to be irregular and jagged. Lack of distinction between the causes of these two types of wounds could lead to profound medico-legal consequences. Blunt impact to any bony part of the body is likely to result in laceration when overlying tissues are forcibly and rapidly pressed against the bone. The orofacial and scalp areas are especially at risk because of the complicated, bony nature of the skull and thin layer of overlying soft tissue (10).

1.5.2. Sharp force injuries

Sharp force injuries extend over the range of incisions and stab wounds. These characteristic injuries are produced by specific implements and weapons, in contrast to blunt force injuries, which may simply occur through falling (10).

Sharp force fatalities have been and will likely continue to be major causes of violent deaths, especially in countries with strict firearms legislation (15). It was the most common cause of homicidal deaths in Sweden 20 years ago and most likely still is, as in many other European countries (16).

To determine the manner of death in general, and differentiate between homicides and suicides is a common and difficult issue in forensic medicine (15). Certain variables may be of importance and help when differentiating between homicides and suicides in sharp force fatalities. In homicide there is a higher number of cut and stab wounds seen in the head, upper and lower extremities and a significantly higher number of vertical stab wounds found in the

chest. Rarely do you find incisions on the wrist and the crook of the arm, unless it is with obvious defence wounds.

When counting the injured areas, regardless of the number of injuries (which is often more in homicides compared with suicides), abdominal wounds and horizontal chest stab wounds were also significantly more often found in victims of homicide. Injuries to the back and to the genitals were not seen in suicide (16).

Sharp force injuries add another layer of importance in evidence when the tools used leave markings on cartilage or bone. Such mark*s* have been used to successfully identify causative weapons and may (indirectly) link killer to their crimes.

1.5.3. Gunshot wounds

Most homicides in major metropolitan regions of the United States are committed with firearms, especially handguns (17). In Sweden since 2011, when firearms were introduced in to the statistics, the number of violent firearm fatalities has more than doubled and in 2018, 40% of the documented violent casualties were committed with a firearm (4). Therefore, a basic knowledge of firearms, its ammunition and an understanding of wound ballistics (the study of the effects of penetrating projectiles on the body) are essential for interpreting gunshot wounds in a forensic autopsy. Besides the increasing range of firearms used, gunshot wounds have basic characteristics that will help to paint a picture of the circumstances surrounding a shooting. The wound can be described as either penetrating or perforating. Penetrating wounds occur when a bullet enters a point but does not exit and in perforating wounds the bullet completely passes through the body, making it important to differentiate an entrance wound from an exit wound. A reddish zone of abraded skin surrounds most entrance wounds no matter the range. While exit wounds, regardless of range of firing all have the same general characteristics. They are typically larger and more irregular than entrance wounds and with rare exception; do not possess an abrasion ring.

It is also possible to determine an approximate distance from where the gun was shot. The distance can be divided into four broad categories: contact, near contact, intermediate, and distant (18).

1.5.3.1 Contact wounds

In contact wounds, the muzzle of the weapon is held against the surface of the body at the time of discharge. Contact wounds may be hard, loose, angled, or incomplete (3gunshot). There are several features that help recognize contact wounds, one being that soot and gunpowder residue in will stain the wound edges, causing a degree of black/grey discolouration that cannot be wiped off. If the soot spread a bit further around the skin of the wound, it means that there was some space between the muzzle of the gun and skin. Another feature of contact wounds may be that the muzzle can leave an ecchymotic or abraded imprint on the skin. And in even harder contact, where the muzzle is pressed firmly against the skin the hot expanding gases from the firmly held gun to the tissue may create tears around the wound.

1.5.3.2. Intermediate range

Intermediate-range gunshot wounds are defined by the existence of punctuate abrasions, produced by fragments of gunpowder striking and abrading the skin. These red punctuate abrasions are jointly termed *stippling* and cannot be washed away, while gunpowder left on the skin and embedded in the abrasions can be washed away. The radius and pattern of the stippling around the wound, can help to determine the range of fire. Intermediate range is normally just under a meter (2-3 feet), but the stippling pattern is depending on the firearm and the ammunition.

1.5.3.3. Distant range

In distant wounds, the only marks on the body are those created by the mechanical action of the bullet perforating the skin (10).

2. OBJECTIVES

Our objective is to investigate homicidal rates of Sweden, and to observe if there is a significant method of execution (cause of death), sex or age peak, that may help reveal hidden areas in need of improvement when instigating new prevention protocols, or for forensic investigation purposes. It is also relevant to see whether homicidal rates in Sweden are growing or declining and assess whether Sweden can be viewed as a safe country in regards to lethal violence.

3. METHODS

3.1. Data Collection

In this study, the main focus was on purposefully inflicted deaths on a person by another in the whole of Sweden between 1st of January 2003 and 31st of December 2017.

Data containing information about the year, sex, age and cause of death was obtained from the National Board of Health and Welfare (Socialstyrelsen) from Sweden.

Codes X85-Y09 from the international classification of disease-10 were used in the analysis. (Any other codes such as manner of death, explaining the circumstances around the cause of death was impossible to obtain making it hard to discriminate between the legal terms of homicide and manslaughter).

3.2. Statistical Analysis

Numbers of completed homicides over this 15-year period were compared to find significant differences in gender, age and cause of death (ICD-10 codes). The statistical analysis was performed using an online chi-square and fisher exact test calculator (from the following web page: https://www.socscistatistics.com/tests/chisquare/default.aspx. *P** value <0.05 was considered to be statistically significant. The graphs were produced using Excel and included homicide fatalities in Sweden over a 15-year period.

4. RESULTS

Table 1. Distribution of homicide frequencies by gender (sex)

The type of homicide N=1258	ICD code	Gender N (%)		P*
		Male N=859	Female N=399	**<0.0001**
		(68.2)	(31.7)	
Assault by poisoning	X85	2 (0.2)	1 (0.3)	0.952
Assault by strangulation, suffocation and hanging	X91	37 (4.3)	65 (16.2)	**<0.0001**
Assault by drowning	X92	5 (0.6)	5 (1.2)	0.212
Assault by handgun	X93	111 (12.9)	9 (2.5)	**<0.0001**
Assault by rifle, shotgun and larger firearm	X94	12 (1.4)	10 (2.5)	0.162
Assault by unspecified firearm	X95	119 (13.8)	29 (7.3)	**0.0007**
Assault by explosive	X96	1 (0.1)	0 (0.0)	0,496
Assault by smoke, fire and flames	X97	10 (1.2)	7 (1.7)	0.399
Assault by sharp objects incl: stabbing	X99	374 (43.5)	183 (45.9)	0.092
Assault by blunt object	Y00	60 (6.9)	38 (9.5)	0,118
Assault by pushing from high	Y01	4 (0,5)	2 (0.5)	0.932
Assault with motor vehicle	Y03	8 (0,9)	3 (0,8)	0.750
Assault by bodily force incl: unarmed fight	Y04	57 (6.6)	12 (3.0)	**0.009**
Other maltreatment by another specified person	Y07.8	0 (0.0)	1 (0.3)	0.142
Other maltreatment by unspecified person	Y07.9	0 (0.0)	2 (0.5)	**0.038**
Assault by other specified means	Y08	3 (0.3)	2 (0.5)	0.690
Assault by unspecified means	Y09	42 (4.9)	24 (6.0)	0.405

**Chi squared test*

Within the observed 15 years, there were 1258 homicides in total, 859 males and 399 females (Table 1). Looking at the statistics, men, as victims of homicide are largely over-represented. Results of our study indicate statistical differences between genders and type of assault in five different categories (Table 1). ICD-10 code X85 shows a statistical difference between men and females, with 65 (16%) of all female murders being committed by strangulation, suffocation or hanging, while it only was the cause of death for 37 (4%) of the over-representing males (P<0.001, Table 1).

Assault by handgun killed 111 males and 9 females (P<0.001, Table 1), and assault by unspecified firearm killed 119 males and 29 females (P<0.0007, Table 1).

A total of 57 men and 12 females were killed from assault by bodily force, including unarmed fights, and showed a statistical significance (P<0.009, Table 1).

The significant difference found by Y07.9 (other maltreatment by unspecified person) was cause of death in 2 females whereas no male subject had maltreatment by unspecified person registered as a cause of homicide (P=0.038, Table 1).

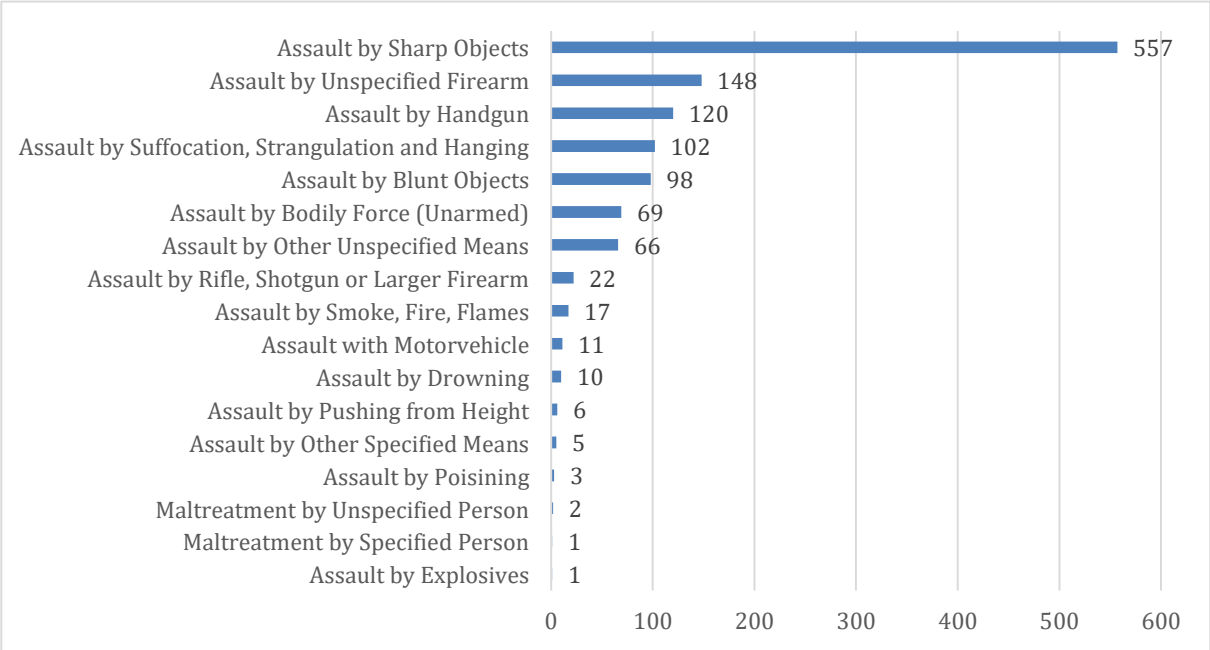

Figure 1. Total number of homicides over the past 15 years.

In Figure 1, the most frequent types of homicides are presented. The most common means of homicide in both females and males is assault by sharp object (X99), including

stabbing. Killing a total of 557 people. The second and third most common means of murder is by handguns and other firearms and in third place is suffocation, strangulation and hanging, all exceeding 100 deaths.

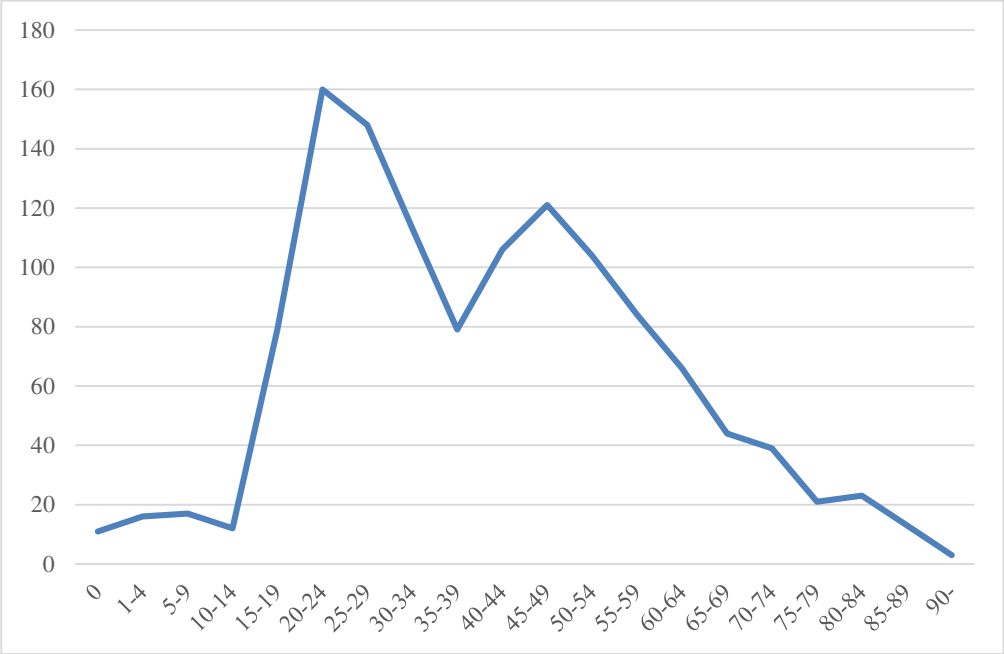

Figure 2. Number of Homicides in Age Groups

When analyzed according to the age group, results of our study indicate the peak in number of homicides just after 15 years of age, reaching its highest number of homicides (160) by early to mid twenties (20-24 years, Figure 2). After a decline in homicides in the thirties and early forties, a second peak between 45 to 50 years was observed, reaching around 120 homicides, followed by a constant following decline (Figure 2).

Table 2. Types of homicide by age groups

The type of homicide (N=1258)	ICD code	Age groups N (%)			
		By 30 years (N= 443)	30-50 (N=419)	Above 50 (N=397)	P*
Assault by poisoning	X85	2 (0.5)	0 (0.0)	1 (0.3)	0.396
Assault by strangulation, suffocation and hanging	X91	40 (9.0)	23 (5.4)	39 (9.8)	0.052
Assault by drowning	X92	6 (1.3)	2 (0.5)	2 (0.5	**0.045**
Assault by handgun	X93	70 (15.8)	36 (8.6)	14 (3.5)	0.051
Assault by rifle, shotgun and larger firearm	X94	11 (2.5)	7 (1.7)	12 (3.0)	**0.043**
Assault by unspecified firearm	X95	72 (16.3.)	58 (13.8)	22 (5.5)	0.402
Assault by explosive	X96	0 (0.0)	1 (0.2)	0 (0.0)	0.334
Assault by smoke, fire and flames	X97	9 (2.0)	3 (0.7)	5 (1.3)	0.415
Assault by sharp objects incl: stabbing	X99	168 (37.9)	213 (50.8)	177 (44.5)	**0.002**
Assault by blunt object	Y00	19 (4.3)	31 (7.4)	48 (12.1)	0.122
Assault by pushing from high	Y01	2 (0.5)	1 (0.2)	3 (0.8)	0.058
Assault with motor vehicle	Y03	1 (0.2)	0 (0.0)	0 (0.0)	0.334
Assault by bodily force incl: unarmed fight	Y04	18 (4.0)	19 (4.5)	31 (7.8)	0.787
Other maltreatment by another specified person	Y07.8	1(0.2)	0(0.0)	0(0.0)	0.334
Other maltreatment by unspecified person	Y07.9	0 (0.0)	0 (0.0)	1 (0.2)	0.334
Assault by other specified means	Y08	2 (0.5)	0 (0.0)	3 (0.7)	0.496
Assault by unspecified means	Y09	13 (2.9)	22 (5.3)	34 (8.6)	**0.039**

* Fisher exact test

When we analyzed different causes of death according to the different age groups we found only four categories to differ; assault by drowning ($P<0.045$, Table 2), assault by rifle, shotgun and larger firearm ($P<0.043$, Table 2), assault by sharp object ($P<0.002$, Table 2) and assault by unspecified means ($P<0.039$, Table 2).

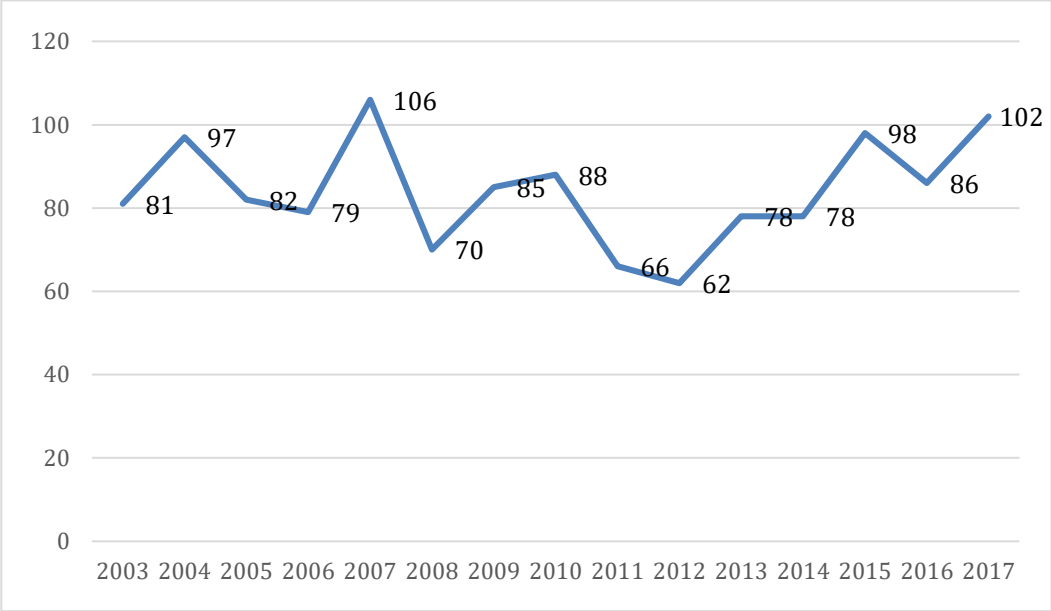

Figure 3. Total Number of Homicides for each year, between years 2003 to 2017.

Figure 3. shows that the highest number of homicides in all of the 15 years was 2007, with 106 deaths. The year with the lowest number of homicides was 2012 with 62 deaths. The annual average of homicides during this period was 84.

Table 3. Gun deaths vs. Stabbings

Type of homicide	ICD-10	Total (N=1258)	Males (N=859)	Females (N=399)	P* (males and females)
Firearms	X93, X94, X95	290(23.0)	242 (28.2)	48(12.0)	**<0.0001**
Sharp Objects	X99	557(44.2)	374(43.5)	183(45.9)	<0.63

** Chi square test*

X93- assault by gunshot
X94- assault by rifle, shotgun or larger firearm
X95- assault by unspecified gunshot
X99- assault by sharp objects, including stabbing

We combined all three ICD-10 codes associated with deaths caused by guns, and compared these numbers with the total number of stabbings (Table 3). Results indicate that even collectively, assault by sharp objects is more common means of murder, and there is a statistical significance between male who are more often victims of homicides by firearms compared to females (242 vs 48, $P<0.0001$, Table 3).

5. DISCUSSION

This study examined the number of murders in Sweden over a period of 15 years. We analyzed the gender and age of the victims and ways of execution (cause of death). The results showed that more males fall victim to homicide than females and are more likely to be of adolescent age. The most common cause of death is by assault with a sharp object for both genders. More females are killed by suffocation and men are more often killed with guns.

On an average there are 84 homicides per year in Sweden (calculated between 2003-2017), bringing about an annual rate just over 1 per 100.000. In 2017 the rate was 1.12 per 100.000 in relation to the population (4). This may sound low, but it puts Sweden in the middle when comparing murder rates with other EU countries. In 2016 there were 13 EU countries with an annual homicide rate below 1 per 100.00 (19). Europe as a regional area has one of the lowest rates of homicide in the whole world and has over the past 30 years seen a continued decrease in homicide rates (3). However, there are still over 5000 homicides annually in Europe and certain countries such as France, Germany and the United Kingdom has over recent years had an increase in homicide rates (when including terrorism-related deaths). That being said, comparing Sweden's homicide rates to countries such as the United States, which is a further developed country similar to most European countries, they had a homicide mortality rate of 6.2 per 100.000 in 2017 (20).

When observing Sweden's rates over the past 15 years, there is a slight trending decline after 2007, the year with most homicides taking 106 lives. The decline lasts until 2014, with the lowest number in 2012 with 62 murders. Unfortunately, after 2014 the number of homicides rises back to higher numbers with just over 100. Reasons behind this rise could be multifactorial, one could speculate that the cause for the latest rise in homicides in Sweden are similar to the increases mentioned earlier in other European countries, but it cannot be explained with the data collected from this study and would need further investigation.

Gender as a risk factor for becoming a victim of homicide proved to be significant when comparing populations in Sweden, with men being over-represented. As stated in the results, 68 % of the people who lost their lives through homicide were men. This actuality is not isolated to Sweden. In 2012, on a global scale, 79% of all homicide victims were male. You are likely to find similar findings in data from earlier and more recent years. (21). This may be explained by the fact that the vast majority of homicide perpetrators are male, meaning that the overwhelming pattern is that men kill both men and women. This is suggested through data from available countries concerning convicted homicides, which shows that on average 95% of

all persons convicted of homicide are men. This indicates that male victims of homicide are more likely to be killed by a non-intimate or non-family acquaintance. For women it is however rare to be killed by a stranger, it is far more likely to be carried out by their husband or an intimate acquaintance (22). Not visible through above result, but by the Swedish Crime Survey, it was proven that out of 33 cases of lethal violence against women in 2018, 22 of these cases were against women in a close relationship to their perpetuator.

Our results indicated peak in number of victims at an age between 20 to 24 years of age, reaching 160 victims. The number of deaths starts rising at 15 years of age and begins to decline by 30 years. These results validate a risk factor stated in the introduction, that in societies where younger especially males who cover a large portion of the population, tend to have higher homicidal rates. This assumes that younger men are more likely to kill each other. The second peak was observed at 45-49 years of age, with 121 homicides. It could be interesting to see at what age females have a larger risk of being murdered compared to men. Unfortunately, this was not possible to prove with the data used for this study, which might have helped explain the second wave.

We found four homicide categories (causes of death) with statistical differences when dividing the homicide victims ages into 3 age groups (below 30, 30 to 50 and above 50). Those categories were assault by drowning, assault by rifle, shotgun or larger firearm, assault by sharp object, and assault by unspecified means. Out of these four causes, assault by sharp object was the reason in 50% of death of all the victims between 30 to 50 years of age.

When looking at the cause of death in regards to murder, stabbing is still the most common. This goes for both males and females, with it being 46% of all female homicides and 44% for males.

The second most common cause of death is by firearm. Comparing number of murders by firearms in Sweden to the USA demonstrate one possible risk factor, the availability of guns. The USA are known for the heavy debate with regards to their lenient gun laws and ‘right to bear arms’. Availability is a modifiable risk factor that has large impact on prevention protocols.

Firearms were used in 23% of all murders in Sweden since 2003. Whilst in America where guns are more available, 68% of all murders in 2011 were by firearms out of an estimated 14,612 murders. Most murders in the USA are committed with guns (17). In the cases where a

firearm was used in Sweden, the victim was a man in 28 % of cases and only in 12 % of the cases was the victim a woman. Reasons for this could be gang violence.

Even though when it comes to total number of homicides, there are only half as many female victims compared to male. However there is a significant difference in strangulation. Strangulation constitutes 16% of all female murder victims in Sweden; as for men it is only the cause of 4%. This again can underline the need of having data describing the manner of death, which would prove that females are more likely to be killed in their homes by their partners or near family member, than by a stranger.

Understanding where, when and how any injury to a mysterious body occurred and finding the cause of death is not an easy task. Putting together how certain events took place is important for documenting a crime and has a large impact on the statistics of homicide and manslaughter crimes in a country. Understanding the epidemiology of homicide, its risk factors in regards to gender, age and way of execution may help direct an investigation, where to take extra concern, such as stab wounds, strangulation marks and gun wounds.

Evaluation of the data yielded a number of results, all which may hopefully be useful when over viewing new prevention policies against violence in Sweden and in epidemiology for forensic medicine.

6. CONCLUSIONS

The present study, investigating murder rates in Sweden with factors such as gender, age and most common cause of death yielded following results.

1. Gender as a risk factor for becoming a victim of homicide proved to be significant regarding males.

2. Assault by strangulation, suffocation and hanging showed to be more common towards females, while gun violence showed a higher incidence rate in males over females

3. Assault by sharp object is the most common cause of death in both males and females, causing 44% of all male and 46% of all female homicides.

4. Young age, between 15 to 29 years, has the highest risk of falling victim to homicide.

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8. SUMMARY

Objective: The main objective of this paper was to analyse risk factors associated with murders and to establish the most common causes of deaths caused by murder in Sweden over the past 15 years.

Subjects and Methods: This work was organized as a retrospective study, analysing all homicides in Sweden between the 1st of January 2003 and 31st of December 2017. The data collected was supplied with courtesy of the National Board of health and Welfare of Sweden (Socialstyrelsen) and the Swedish cause of death registry. The statistical analysis was compared using Chi-square calculations and fisher exact test.

Results: From 2003-2017, there were 1258 homicides in Sweden. Total of 859 victims were male and 399 were females (P<0.0001). 65 females and 37 males died from assault by strangulation (X91) (P<0.0001). Assault by firearms (X93-95) killed 255 males and 53 females (P<0.0001). There were 61 homicides caused by assault by bodily force (Y04), 57 male victims and 12 female victims (P=0.009). The most common means of homicide in both females and males is assault by sharp object (X99), including stabbing. 2007 had the most homicides of all 15 years with 106 deaths, 2012 was the lowest with 62. 160 people between the age of 19 to 24 fell victim of homicide.

Conclusion: The most significant risk factors associated to a murder victim in Sweden is, male and young age (below 30). The most common cause of death is assault by sharp objects including stabbing, regardless of gender. More females are victims of strangulation than males are and males have a higher homicide rate by firearms than females.

9. CROATIAN SUMMARY

Naslov rada: Analiza stope ubojstava u Švedskoj, prema spolu, dobi i uzroku smrti između 2003. i 2017. godine.

Ciljevi: Osnovi cilj ovog rada bio je analizirati čimbenike rizika koji su povezani s ubojstvima u Švedskoj u posljednjih 15 godina, te utvrditi najčešće uzroke smrti s prikazima usporedbi stope ubojstava s drugim zemljama.

Ispitanici i Metode: Rad je organiziran kao retrospektivna studija kojom je prikazana analiza slučajeva ubojstva koji su se dogodili u Švedskoj između 1. siječnja 2003. i 31. prosinca 2017. Podatci o slučajevima ubojstva su dobiveni zahvaljujući susretljivosti Nacionalnog odbora za zdravstvo i socijalnu skrb Kraljevine Švedske. Prikazani su kao kategorijske varijable, apsolutnim i relativnim frekvencijama, a za testiranje statistički značajne razlike korišten je χ^2-kvadrat test odnosno Fisherov egzaktni test.

Rezultati: Od 2003. do 2017. u Švedskoj je bilo 1258 ubojstava. Ukupno 859 žrtava su muškarci, a 399 žene ($p < 0,0001$). 65 žena i 37 muškaraca umrlo je od napada davljenjem (X91) ($p < 0,0001$). U napadu vatrenim oružjem (X93-95) ubijeno je 255. muškaraca i 53 žene ($p < 0,0001$). Bilo je 61 ubojstava uzrokovanih napadom tjelesnom silom (Y04), 57 muških žrtava i 12 ženskih žrtava ($p = 0,009$). Najčešći način ubojstva i žena i muškaraca je napad oštrim predmetom (X99), uključujući ubode. U 2007. godini bilo je najviše ubojstava u svih 15 godina, sa 106 smrtnih slučajeva, 2012. najmanja sa 62. 160 ljudi u dobi od 19 do 24 godine postalo je žrtvama ubojstava.

Zaključak: Najznačajniji čimbenici rizika povezani sa žrtvama ubojstva u Švedskoj su muškarac mlađi od 30 godina. Najčešći uzrok smrti je napad oštrim predmetima, uključujući ubod nožem, bez obzira na spol. Utvrđena je statistički značajna razlika između kategorije spola za slučajeve davljenja.

Ključne riječi: ubojstvo, ICD klasifikacija uzroka smrti,

10. CURRICULUM VITAE

Personal Data

Name and surname:Emma Jenks

Date and place of birth: 17.07.1993, Bromma, Sweden

Citizenship: Sweden

Phone: +385 95 897 5305

Email: emma_jenks_93@hotmail.com

Language: Swedish and English

Education

2013-2019. Medical Studies in English, Medical Faculty, University of Split, Croatia

2009-2012. High School diploma, Västerbergslagens Utbildnings Centrum Ludvika Gymnasium

Related experience

2018-2019. Chairman for the Swedish Medical Association SYLF-Split