

## Homicide in Denmark 1992–2016

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### ABSTRACT

We present the findings for homicides in Denmark for 1992–2016. There were 1417 homicide victims (62.2% males, 37.8% females) that were killed in 1321 homicide events. The most common methods were sharp force trauma (33.2%), gunshot (22.2%), blunt force trauma (21.9%) and asphyxia (17.6%), and all methods exhibited a reduction during the study period. The homicide rate was 1.05 per 100,000, 1.32 per 100,000 for males, and 0.78 per 100,000 for females.

Domestic homicides were the largest main group of homicides (76.5% of all female victims vs. 23.6% of male victims). Of the non-domestic homicides, 84.2% of victims were male, the largest group being in the setting of nightlife and/or intoxication. Most female victims (76.9%) were killed by someone in their family, while the largest share of male victims (34.5%) were killed by a friend or acquaintance. The offenders were males in 87.9% of all homicides.

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### 1. Introduction

Interpersonal violence has wide public attention and claims many lives every year worldwide [1]. Homicide as a medical manner of death can be identified as deaths from intentional trauma inflicted by another person and includes murder, aggravated assault and in some countries (including Denmark) legal intervention [2,3]. The homicide rate in a country is an indicator of the level of interpersonal violence, but the association varies between countries and through time [4]. The variation originates from factors, such as weapons used, access to medical facilities and access to trauma centers, as well as more general changes in society. The homicide rates in the Western World increased from the late 1960s until the early 1990s, when it started decreasing [4]. To understand the changes, it is necessary to look at homicides on a more detailed level than just the rates.

The Danish Register of Causes of Death is based on death certificates [5] and only publishes broad annual data for homicides, i.e.,

the number of homicides broken into sex, age groups and region, with restrictions on how small groups can be reported. Data on the homicide methods for recent years are not readily available to the public but can be acquired for a fee. As all homicide victims in Denmark by law are required to undergo medicolegal autopsy, the autopsy reports are a valid alternative data source for homicide studies, allowing for more information to be collected than from a death certificate.

Homicide in Denmark from the perspective of Forensic Medicine has not been subjected to a national review since the period of 1946–1970 (N = 892) [2]. However, there have been regional studies of homicides in Denmark/Norway (Copenhagen/Oslo) for the period of 1985–1994 (N = 431, N<sub>Copenhagen</sub> = 275) [6] and in Southern Denmark for 1983–2007 (N = 166) [3]. These studies focused on various general elements regarding the act of homicide, such as methods, motives and relation between victims and offenders. Since 1970, there have been many changes in Danish society, ranging from general demographics and family structure to access to advanced medical facilities and illegal drugs. How this has affected the homicide pattern on a national level is unknown. A contemporary study of homicides in Denmark will be of use in death investigations and can lead to a better understanding of homicides on a regional and global scale. We provide data on all

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homicides in Denmark for the 25-year period of 1992–2016.

## 2. Materials and methods

In 1992–2016, Denmark had an average population of 5.41 (5.16–5.71) million [7]. All medicolegal autopsies were performed at one of the three departments of forensic medicine in Copenhagen, Odense or Aarhus.

We retrieved 1439 autopsy files from the departments of forensic medicine for 1992–2016 coded for homicide as the manner of death. The main documents on file were the autopsy reports (including crime scene examination of the victims), initial police reports, crime scene photos and autopsy photos. Approximately one-third of the files had supplementary police reports and court documents, which we studied in cases with unclear descriptions in the main documents. A total of 97 deaths coded as homicides (false positive) were excluded due to simple misclassification in the file system (38 deaths), the homicides occurring abroad (35 deaths) or a court ruling the death as a non-homicide (24 deaths); the latter typically involved single injuries from knives or firearms.

To find misclassified homicides (false negative), we retrieved all autopsy files where the National Police had taken photos at the autopsy, indicating the death being suspicious of homicide. This yielded 34 additional deaths that had been misclassified as non-homicidal, which was confirmed by police files and/or court files. We also compared the list of homicides to the annual mass media accounts (via the media service, infomedia.dk), generating 41 additional misclassified deaths, which were confirmed by autopsy reports and/or court reporting.

The final list had 1417 homicides, including medicolegal autopsies for 740 homicides in Copenhagen (52.2%), 471 homicides in Aarhus (33.3%) and 196 homicides in Odense (13.8%), as well as 4 (0.3%) homicides with only an external examination, and 5 (0.4%) homicides without a recovered victim, but with sentencing of an offender.

For the current study, we collected information about the victim and offender, circumstances of the homicides, motive, relation between victim and offender, homicide method, and whether the offender attempted or committed suicide.

We registered data for each homicide electronically using Epi-Data (EpiData Association, 2010, Odense, Denmark. <http://www.epidata.dk>), followed by exporting the data to Stata (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LLC.) and Rstudio (RStudio Team (2015). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA; <http://www.rstudio.com/>) for statistical analysis and data visualization. Where appropriate we analyzed data with linear regression and Kruskal-Wallis rank sum test, with a significance level of 0.05. The project has been approved by the Danish Data Protection Agency.

## 3. Results

The 1417 homicide victims included 881 (62.2%) males and 536 (37.8%) females. The mean annual number of homicides was 56.7 (29–78), 35.2 (18–49) for males, and 21.4 (10–35) for females. The homicide rate was 1.05 per 100,000, 1.32 per 100,000 for males and 0.78 per 100,000 for females. The highest rate was 1.51 per 100,000 in 1992, and the lowest rate was 0.52 per 100,000 in 2012.

The most common homicide methods were sharp force trauma, gunshot, blunt force trauma and asphyxia, accounting for 95.1% of all homicides (Fig. 1). In the deaths from asphyxia, 68.0% of the victims were females, while 68.6% of the victims were males in all other methods combined.

The most common methods all exhibited a significant reduction

over the 25 years, resulting in an overall decrease of homicides (Fig. 2) with an annual decrease of 1.4 homicides per year (linear regression:  $P < 0.001$ ,  $F = 38.9$ ,  $R^2 = 0.63$ ). The homicide rate (per 100,000) showed an annual decrease of 0.03 per year (linear regression:  $P < 0.001$ ,  $F = 53.4$ ,  $R^2 = 0.7$ ) (See Supplementary Fig. 1). The decrease affected both sexes.

The homicides were committed in 1321 events distributed in 1249 events with one victim and 72 events with multiple victims (168 victims, 2–6 victims per event). The annual decrease for single victim events was 1.25 homicides per year (linear regression:  $P < 0.01$ ,  $F = 32.6$ ,  $R^2 = 0.59$ ) and for multiple victim events 0.25 homicides per year (linear regression:  $P < 0.05$ ,  $F = 7.9$ ,  $R^2 = 0.26$ ) (Fig. 3). There were no notable sex differences in the number of homicides in multiple victim events.

### 3.1. Age of victims

The mean age of male victims was 37.3 years (0–91,  $sd = 17.8$ ) and 39.3 years (0–91,  $sd = 21.3$ ) for females (Fig. 4), and 67.1% of the victims were 25–64 years old. The highest age-adjusted rate for a given age was 2.3 per 100,000 for the age of 0–1.

### 3.2. Time of homicide

The time of day for the homicide was known in 75.1% of the homicides. Most of the homicides occurred in the nighttime, i.e., from 6 p.m. to 6 a.m., often on Friday and Saturday evenings and following nights (Fig. 5). For male victims with known time of the homicide, 71.6% were during nighttime vs. 55.3% for female victims.

There were no significant seasonal or monthly variations (Kruskal-Wallis rank sum test, standardized for days per month).

### 3.3. Domestic vs. non-domestic homicides

We have grouped the homicides (Figs. 6 and 7) based on the typology of the European Homicide Monitor [8]. This typology recognizes the importance of victim-offender relations as well as the difficulties in pinpointing a single motive for each homicide.

Domestic homicides were the largest main group of homicides and accounted for 76.5% of all female victims vs. 23.6% of male victims. Intimate partner homicides include current partners as well as ex-partners and showed the strongest sex difference, as 298 of the 376 intimate partner homicide victims were female (79.3%) and accounted for 55.6% of all female victims. In contrast, only 8.9% of male victims were killed by a current or ex-partner. The rate of intimate partner homicides was 0.28 per 100,000, 0.44 per 100,000 for female victims, and 0.12 per 100,000 for male victims. When including homicide events with multiple victims, e.g., killing of a

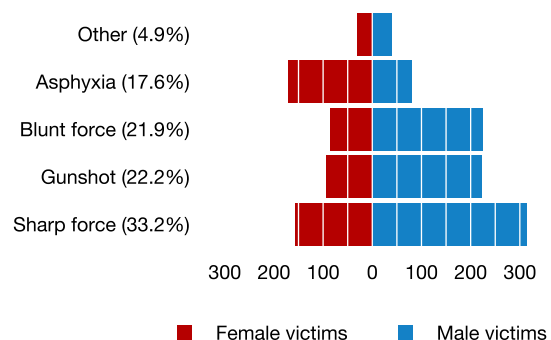
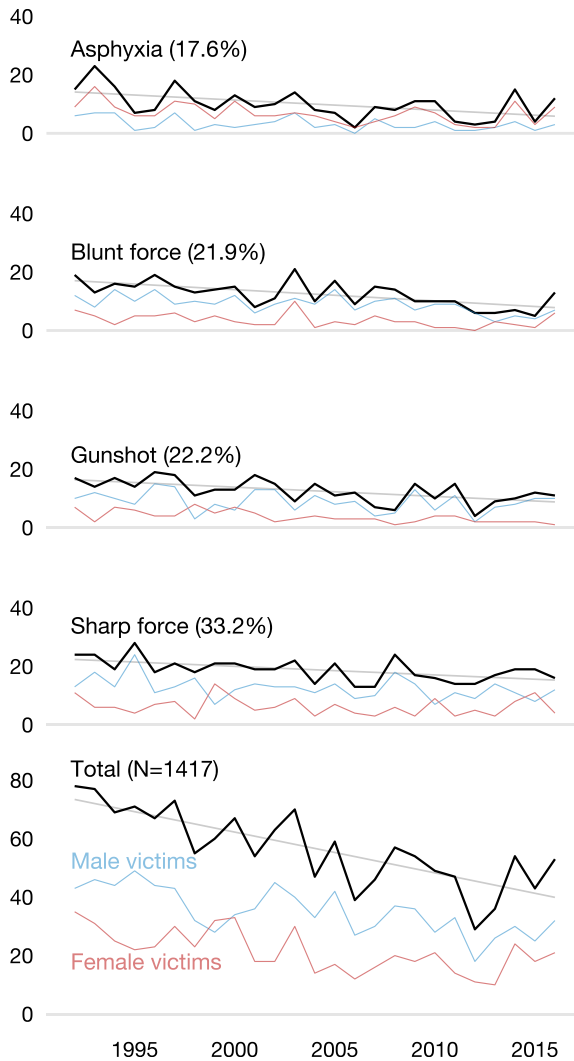


Fig. 1. Homicide methods related to sex of victim. The bars show the number of homicides for each main group (See Supplementary Table 1).



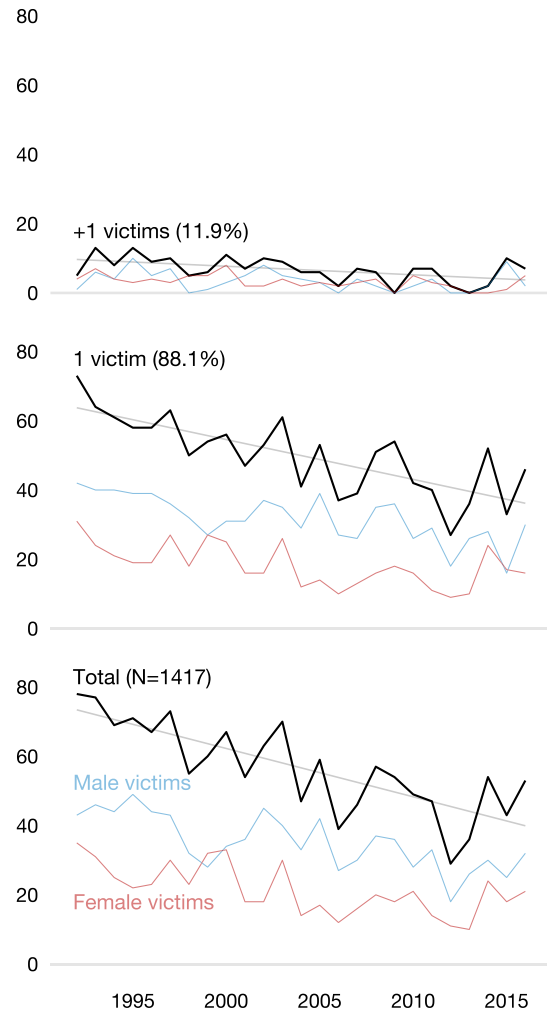
**Fig. 2.** The change in the number of homicides 1992–2016 in the main groups of homicide methods and total homicides.

partner and a child, 410 (28.9%) homicides had an intimate partner component. The intimate partner homicides with male victims were to a much higher degree committed in a setting with the victim provoking the homicide by being violent or threatening with violence towards the offender (at least 33.3% for male victims vs. 0.7% for female victims.). On the other hand, the intimate partner homicides with female victims had separation and/or jealousy as a part of the motive (at least 38.2% for female victims vs. 9.0% for male victims). There were no differences between the sexes of victims in the domestic child homicides, but 75.0% were killed by their father (see below).

For the 799 victims of non-domestic homicide, 673 were male (84.2%). Homicides in the setting of nightlife and/or intoxication was the largest single group with 222 male victims. Triviality, such as a spilled beer or a wrong glance, was an element of the motive in at least 61.3% of those homicides.

#### 3.4. Relationship between victim and offender

The relationship between victim and offender showed strong differences between female victims and male victims (Fig. 8). For female victims, partner/ex-partner was by far the largest group (56.0%), and some kind of family relation accounted for 76.9% of all



**Fig. 3.** The change in the number of homicides 1992–2016 for homicide events with one victim and multiple victims.

female victims. In comparison, male victims were dominated by a friend or acquaintance relationship to the offender (34.5%). For child homicides, there were no differences between the sexes.

In the 9.1% of homicides where mental illness was stated as part of the motive only 7.0% of victims had no relation to the offender. The victim was a relative in 67.4%, the largest group being parents.

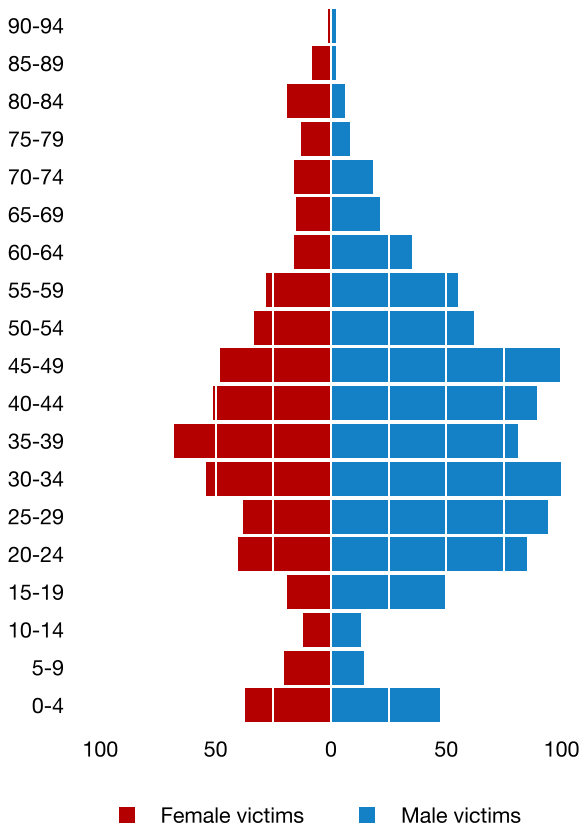
#### 3.5. Location of homicides

The location of the homicides form clusters that overlap with the larger cities (Fig. 9).

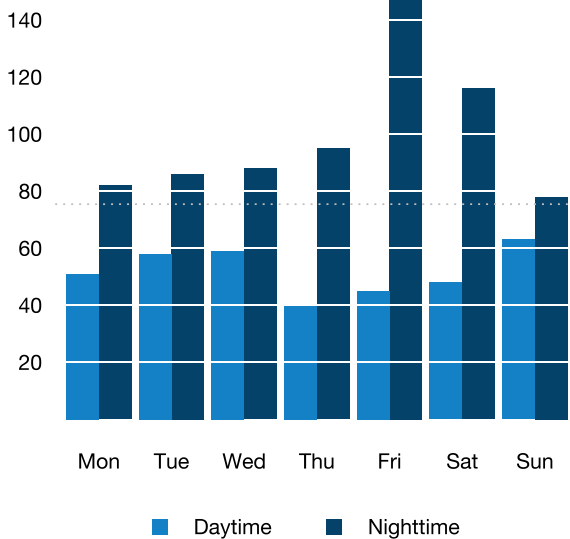
The majority (76.6%) of homicides occurred in residential areas (Fig. 10), and most of these homicides occurred inside (84.9%). In contrast, 52.1% of the homicides were at bars and other service areas and 98.6% of the homicides in traffic areas occurred outside (26.4% in cars). A larger share of female victims than male victims were killed inside (85.8% vs. 66.9%). The location of the homicide was in the home of the victim and/or the offender in 80.8% of the female victims and 56.5% of the male victims.

#### 3.6. The offenders

The offender's sex was known in 1333 (94.1%) homicides, with 87.9% of all homicides having only male offenders (Fig. 11). In 12.4%

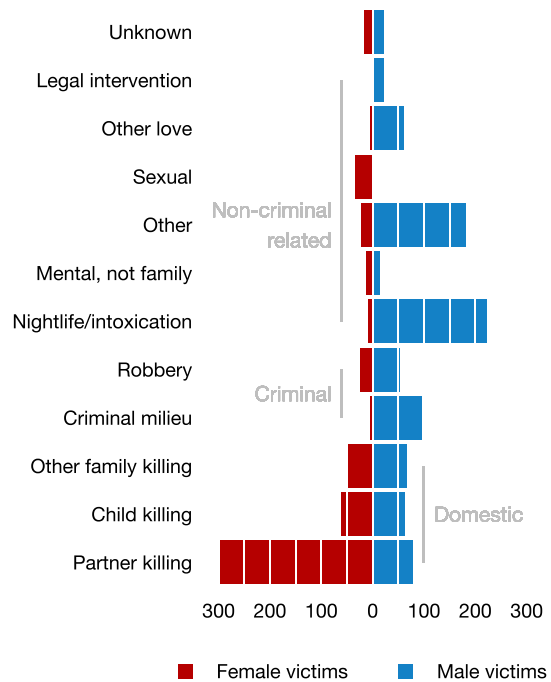


**Fig. 4.** Age-sex pyramid for homicide victims. The bars show the number of homicides for each age group in 5-year intervals.

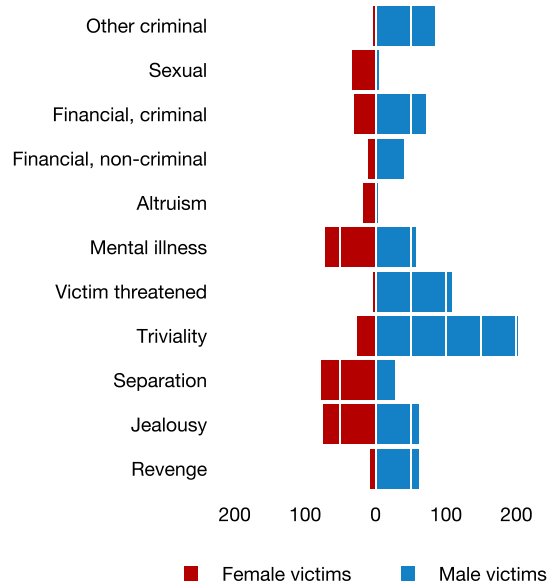


**Fig. 5.** The time of the homicide, weekday and time of day. The bars show the number of homicides for each 12-h time slot. The dotted line represents the mean.

of the homicides, there were multiple offenders, and none of the homicides were female-only. Domestic homicides accounted for 47.2% of the homicides with male offenders vs. 80.7% with female offenders. The same numbers for intimate partner homicides were 29.1% vs. 50.4%. There were 1134 homicides (1051 homicide events) with one offender, in which the age of the offender was available. The mean age of male offenders was 36.2 years (13–88, *sd* = 13.8)



**Fig. 6.** Homicide type related to sex of victim. The bars show the number of homicides for each main group (See [Supplementary Table 2](#)).



**Fig. 7.** Motive related to sex of victim. The bars show the number of homicides for each main group, and each homicide can be represented in more than one group.

and 35.4 years (13–71, *sd* = 11.7) for females, and 74.6% of the offenders were 25–64 years old (Fig. 12).

### 3.7. Suicide after homicide

The offender committed suicide following 9.8% of the homicide events and attempted suicide following 3.6% of the homicide events. Male offenders were responsible for 90.5% of the suicides and 81.3% of the attempts (Fig. 13). There were no sex differences in the proportion of offenders who committed or attempted suicide. Domestic homicides accounted for 87.8% of the homicides

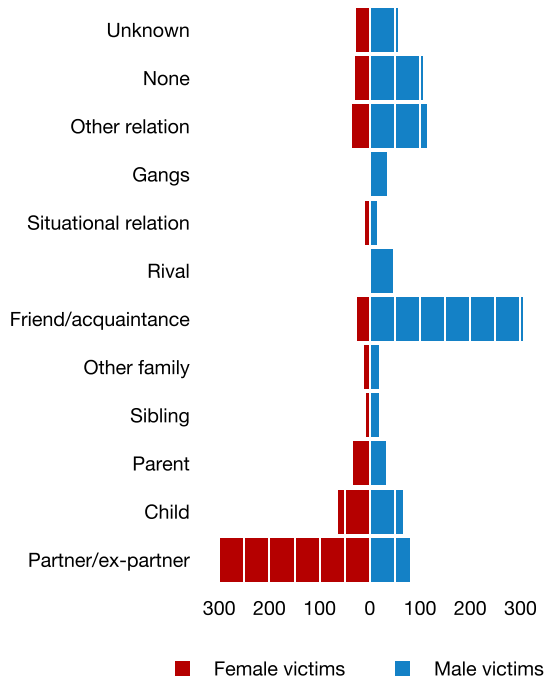


Fig. 8. Relation of homicide victim to the offender(s). The bars show the number of homicides for each main group (See Supplementary Table 3).

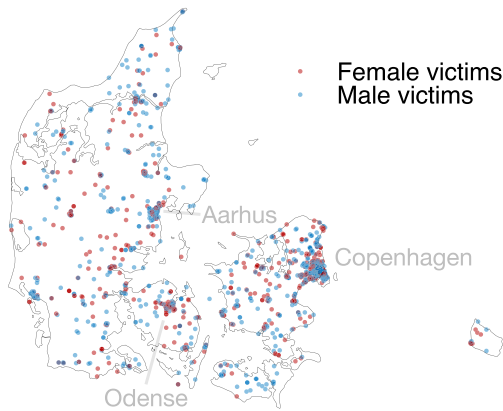


Fig. 9. Map of Denmark with plots of the homicide locations.

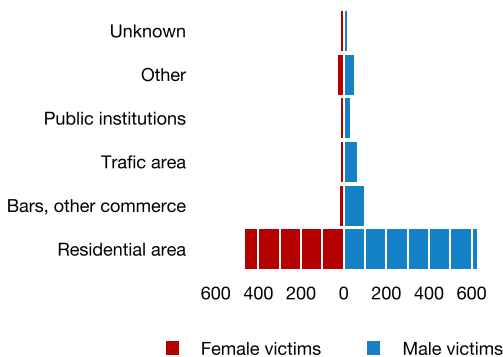


Fig. 10. Homicide type of location related to sex of victim. The bars show the number of homicides for each main group.

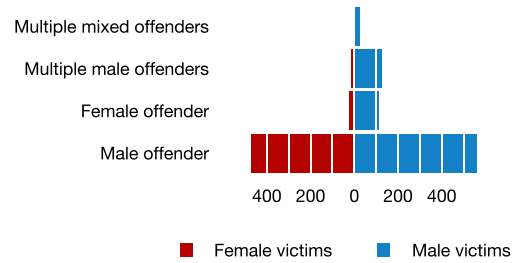


Fig. 11. Offender sex related to sex of victim. The bars show the number of homicides for each main group.

followed by suicide or attempted suicide. In domestic homicides, the offender committed or attempted suicide in 24.9% of homicides with one victim vs. 66.7% of homicides with multiple victims. Of the single victim homicides with suicide or attempted suicide, 64.1% were intimate partner homicides, while 63.2% of the multiple victim homicides were child homicides.

Half of the offenders who committed suicide used the same method as for the homicides, whereas only one-fifth of the offenders who attempted suicide used the same method. Most (84.5%) suicides were committed immediately following the homicide.

### 3.8. Multiple regression

Table 1 shows multiple regression models with victim sex as response variable and homicide method, year of homicide, victim age, main homicide type (domestic, criminal milieu and non-criminal related) and time of day as predictor variables with modelling of interaction between homicide method and main homicide type. Except for year of homicide all predictors had significant effect on victim sex, most pronounced for main homicide type.

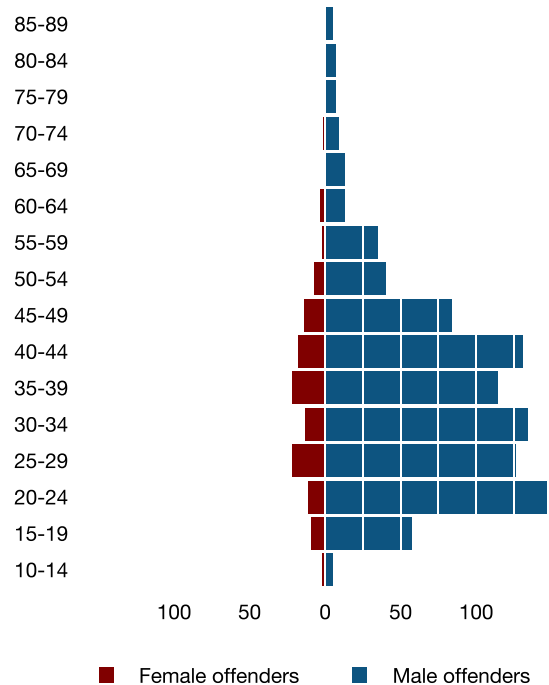


Fig. 12. Age-sex pyramid for homicide offenders. The bars show the number of offenders for each age group in 5-year intervals.



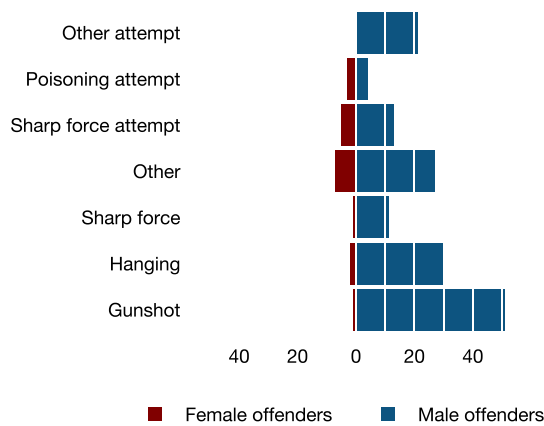


Fig. 13. Offender suicide method related to the sex of the offender. The bars show the number of offenders for each main group.

#### 4. Discussion

Denmark has a relatively low homicide rate that is comparable to the reported homicide rates of other Western European countries, as is the drop since the 1990s [4,8,9]. The reasons for fluctuations in the homicide rate are manifold. Psychosocial factors that often go hand-in-hand, such as substance abuse, mental illness and prolonged unemployment, are responsible for some of the variations [10]. Substance abuse is thought to result in an increased risk of violence due to proximal factors, e.g., cognitive impairment and increased aggression, as well as distal factors, e.g., lifestyle and contact with other intoxicated people [11]. With respect to male victims, the largest subgroup was homicides in the nightlife and/or with intoxication as the main component. It is well known that most homicides occur in the evening or nighttime and weekends with overrepresentation of alcohol intoxication and/or illicit drug use [2,6,8]. This result is similar to homicides in Denmark during 1946–1970 [2], although the study focused on alcohol. The high rate of triviality as part of the motive in the homicides in the nightlife and/or with intoxication indicates the potential for prevention by reducing alcohol intake.

The role of a civilizing process is mentioned as an explanation for the great decline in homicide rate through historical time, whereas technology of healing, i.e., better telecommunication, transport and medical advances is thought to have a role in more recent history [4,12]. In our study period, the public's access to mobile phones and localization technology (Global Positioning System (GPS), etc.) has increased dramatically improving response times for ambulance services [13] and has lowered the rate of death at the scene [14]. There has also been a remarkable development in pre-hospital and in-hospital care to trauma patients with reduced mortality [15,16], although there are some suggestions that survival has not increased in trauma patients in Denmark that reach hospitals alive [17].

That sharp force trauma, gunshot and blunt force trauma are the most common methods is a drastic change from the homicide methods in Denmark during 1946–1970, when asphyxia, poisoning and blunt force trauma were the most common [2] (see below). For 1966–1970, however, poisonings were reduced to less than 4%, with sharp force trauma rising to a shared third position. The Netherlands, Sweden and Finland have a distribution similar to our study [8]. The type of trauma is an important factor when studying trauma-associated mortality. We hope to address this in detail in upcoming studies of each of the common homicide methods in this study, using trauma scores to stratify according to the potential for survival.

Males were prominent in both victim and offender statistics, which is not surprising [8]. The proportion of homicides with female victims and/or offenders followed the proportion of domestic homicides, as seen worldwide [1]. Intimate partner homicide was the driving force behind this sex difference. In homicides in Denmark during 1946–1970 [2], 85% of the victims of intimate partner homicide were female, and the rate was 0.13 per 100,000, i.e., about half compared to 1992–2016. In Southern Denmark during 1983–2007, the rate of intimate partner homicide was 0.2 per 100,000 [18]. The proportion of female and male homicides that were due to intimate partner homicides is somewhat higher in our study than the estimation for high-income countries as a whole [19], but both the proportion and rates are similar to findings in Sweden for 1990–2013 [20]. It is likely that the share of these homicides with separation and/or jealousy was much higher for female victims than we have reported, as the offender committed suicide in 26.6% of these homicides, resulting in a lack of information regarding motive.

For 1946–1970, Hansen described a large decline in child family homicides by carbon monoxide poisoning from town gas with female offenders, owing to better support for single mothers and limited availability of the poisonous gas [2]. It was thought that the ease with which it was possible to turn on the gas, coupled with its high toxicity, made homicide-suicides common. This result can explain the low rate of female perpetrated homicide in 1992–2016 of 12% compared to 1946–1970, where 32% of the offenders were female, with a decrease to 19% for 1966–1970 [2]. In the study from Southern Denmark during 1983–2007 [3], the female offender ratio was 10%, suggesting that the decline in these homicides continued from 1970. During 1946–1970, 25% of all homicide victims died in homicide events with multiple victims [2] compared to 12% in our study, due to the abovementioned reduction in child family homicides. This also explains the drastic reduction in homicide-suicide events (from 30% to approximately 10%) between the two periods. Our findings on homicide-suicide events are consistent with findings from The Netherlands, U.S.A. and Switzerland [21,22] on domestic homicides being the majority, the high frequency of multiple victim events and the common use of firearms. Our data regarding the use of firearms is more in line with the data from The Netherlands than the U.S.A. and Switzerland, most likely reflecting the low rate of gun ownership.

Table 1  
Multiple regression models with victim sex as response variable.

Equation	Variable	R <sup>2</sup>	ΔR <sup>2</sup>	P
victim sex ~ victim age + time of day + method * homicide type	Full model	0.388	—	—
victim sex ~ year + victim age + time of day + method * homicide type	Full model + year	0.373	0.015	0.378
victim sex ~ victim age + time of day + method + homicide type	No interaction	0.373	0.015	<0.001
victim sex ~ victim age + time of day + homicide type	Method	0.379	0.009	<0.001
victim sex ~ victim age + time of day + method	Homicide type	0.175	0.213	<0.001
victim sex ~ time of day + method * homicide type	Victim age	0.375	0.013	<0.001
victim sex ~ victim age + method * homicide type	Time of day	0.362	0.026	<0.05

The majority of victims were in the age group of 25–64 years [8]. This is in stark contrast to 1946–1970, where 42% of the victims were younger than 15 years old (with an age-adjusted homicide rate of 1.35 per 100,000) [2]; again, this decline is a result of the drop in child family homicides. The offender age distribution is similar to 1946–1970 [2] and other European countries [8].

A challenge in epidemiological homicide research is whether all the actual homicides have been included [23,24]. Using official mortality statistics has the advantage of having medically based diagnoses of the manner of death, defined by the International Classification of Diseases, that are more robust compared to the changing legal definitions that can obscure criminal statistics [4]. However, official mortality statistics has some limitations in the sense that the coding of the death certificates occurs prior to the final verdict in court, which means that a true homicide can be registered as a non-homicidal manner of death and vice versa [4]. By combining information from the departments of forensic medicine with court reports and mass media accounts, we believe that we have succeeded in identifying as many homicides as possible while erring on the side of caution by only including the homicides where an investigation and/or trial was in agreement. We have compared the annual number of homicides from our study to the Danish Register of Causes of Death and found that we have an average of 7.9 more annual homicides, supporting that death certificates are an incomplete source for identifying homicides. There are, of course, homicides that will never be recognized, either because the victim is never recovered or due to misdiagnosis at the death investigation. We have identified the homicides in this material, where the homicide was either concealed, staged or misdiagnosed initially and will describe the characteristics in a future study.

Our study is limited by available documents, i.e., autopsy reports, initial police reports, photos and in a limited number of case files also supplementary police reports and court documents. This has led to missing variables regarding detailed offender characteristics, such as psychopathological- and other motivational aspects. We were able to extract general information about mental illness, but it is likely that some offenders had mental illness not described in the available documents. We plan to report general information about mental illness and substance abuse relating to the homicides in an upcoming study with data from the clinical forensic examination and autopsies of the homicide offenders. An avenue of further studies could be a more detailed report on these aspects with data from the psychological evaluation of offenders, as they are crucial in understanding homicide offending in general [25] and in subgroups, such as sexual homicide [26–30].

## 5. Conclusion

We have presented a retrospective overview of homicides in Denmark for a recent 25-year period. The most pronounced difference to the latest similar study from 1946 to 1970 was the large reduction in female perpetrated family homicides. In the intervening period, there has been a rise in the homicide rate with a change in the common homicide methods from poisoning and asphyxia to sharp force trauma and gunshots. Domestic homicides are still the most common group, but with a shift towards intimate partner homicides, often with female victims and male offenders. Males were most often killed by male friends or acquaintances, typically in a setting of intoxication. We found a significant reduction in the homicide rate for the common methods of sharp force trauma, gunshot, blunt force trauma and asphyxia in the study period. Further studies from our research material will hopefully help explore what has contributed to the reduction in the homicide rate.

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## Disclosure

The other authors have nothing to disclose.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.fsisyn.2019.07.001>.

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