UNIVERSITY OF SOUTHERN DENMARK

Ph.D. Thesis

Interpersonal violence in The Odense Municipality, Denmark 1991-2002

The Odense study on deliberate interpersonal violence

Christian Færgemann, MD

Accident Analysis Group
Department of Orthopaedics
Odense University Hospital

Institute of Clinical Research
Faculty of Health Sciences
University of Southern Denmark

National Centre for Register-Based Research
University of Aarhus

Odense 2006

Accident Analysis Group

Odense University Hospital

National Center for Register-based Research

LIST OF ABBREVIATIONS

A&E department:	Accident and Emergency Department
OUH:	Odense University Hospital
IFM:	Institute of Forensic Medicine
SDU:	University of Southern Denmark
AIS:	Abbreviated Injury Scale
NOMESCO:	Nordic Medico Statistical Committee
CI:	Confidence Interval
CPR-number:	Danish Civil Person Registration Number
IDA:	Integrated Database for Labour Market Research
DRHSC:	Danish Register for Health and Social Conditions

ENGLISH SUMMARY

Introduction

The thesis is based on five studies conducted in cooperation between the Accident Analysis Group at Odense University Hospital, the Institute of Clinical Research at University of Southern Denmark, the Institute of Forensic Medicine at University of Southern Denmark, the National Centre for Register-based Research at University of Aarhus, and Odense Police.

Studies 1-4

Objectives

The objectives of the thesis were:

1. To describe the epidemiology of deliberate physical interpersonal violence and repeat violent victimization in the Odense Municipality 1991-2002.
2. To estimate the lifetime risk of violent victimization in the Odense Municipality.
3. To describe the demographic and socioeconomic status of adult victims of violence in the Odense Municipality 1991-2002 compared to population-based controls using a case-control design.

Methods and material

Included were all victims of violence from the Odense Municipality attending the A&E department at Odense University Hospital and/or subjected to medicolegal autopsy at the Institute of Forensic Medicine at University of Southern Denmark 1991-2002. Based on mid-year population counts age and gender specific annual incidence rates were estimated and Poisson regression was used to analyse changes in the study period. Time trends in lesion types, injured body regions, weapon use, and mortality rates were used as indicators of changes in severity of violence in the study period.

Using the Danish Civil Person Registration Number and including a five year run-in period all victims with more than one contact to the A&E department and/or the Institute of Forensic Medicine were identified as repeat victims and recurrent proportions were estimated as the proportion of individuals with more than one contact due to violence in the study period. Kaplan-Meier survival analyses were made with time of observation from first to second contact due to violence. A repetition percentage was estimated as the proportion with repeated characteristics of the incident leading to the second contact compared to the incident leading to the first contact.

Based on age and gender specific annual incidence rates of first time contact with the A&E department and/or IFM and the survival rates of the background population the lifetime risk of contact with the A&E department and/or the IFM through exposure to violence was estimated.

For every adult victim aged 20 years or more five age, gender, and date matched controls were randomly selected from the total population of Odense Municipality. Based on the Danish Civil Person Registration Number demographic and socioeconomic information about cases and controls was extracted from two national longitudinal registers. Different models of demographic and socioeconomic risk factors were constructed and unconditional logistic regression analyses were performed.

Results

In the study period 14,316 victims attended the A&E department at OUH and/or were subjected to medicolegal autopsy at the IFM. The gender specific annual incidence rate was 9.9 (95% CI: 9.7-10.1) per 1000 population/year for males and 3.4 (95% CI: 3.3-3.5) per 1000 population/year for females. For males the rate decreased significantly and for females the rate was unchanged in the study period (Poisson regression, p=0.001 and p=0.588). For both males and females the percentage of less serious lesions increased in the study period (nonparametric test for trend, p=0.01) whereas the percentage of bone fractures and deep lesions decreased significantly for both males (nonparametric test for trend, p=0.01 and p=0.02) and females (nonparametric test for trend, p=0.02 and p=0.03). Three per cent of the victims were stabbed with a knife and 0.4 % had lesions from firearms. The percentages did not change in the study period (nonparametric test for trend, p=0.91 and p=0.94).

Overall 22 % of the individuals were repeat victims who were responsible for 44 % of all contacts in the study period. For individuals with repeat contacts the median number of contacts in the study period was two (range 2-15). The median time span from first to the second contact was 1.75 years (range 0-11.44 years) for males and 1.64 years (range 1.00-9.91) for females. Within four years 79 % of the victims had had the next contact. The median time span from index to the second contact decreased significantly with increasing age. The repetition percentage for weapon use was 17 % for males and 7 % for females. Potentially severe lesions such as bone fractures and internal lesions occurred with a repetition percentage of 28 % and 19 % for males and 23 % and 25 % for females.

The estimated lifetime risk was 0.440 (95 % CI: 0.438-0.442) for males and 0.180 (95% CI: 0.178-0.181) for females. In the adolescence (15-24 years) the cumulative risk was 0.192 (95% CI: 0.188.0.195) for males, and 0.048 (95% CI: 0.046-0.051) for females respectively.

The risk factors most strongly associated with A&E department and/or IFM contact due to adult violent victimization were: not living with a partner (OR: 2.93; 95% CI: 2.74-3.13), an annual household gross income of less than 10,000 € (OR: 2.38; 95% CI: 2.16-2.63), a high lifetime unemployment rate (OR: 1.92; 95% CI: 1.82-2.02), an annual household gross income between

10,000 € and 19,999 € (OR: 1.87; 95% CI: 1.71-2.04), a household crowding of less than 24 m^2 per resident (OR: 1.86; 95% CI: 1.68-2.05), an age difference to partner of five years or more (OR:1.56; 95% CI: 1.43-1.69), and being a pensioner (OR: 1.49; 95% CI: 1.36-1.63). The most important factors negatively associated with A&E department and/or IFM contact due to adult violent victimization were: being a student (OR: 0.23; 95% CI: 0.20-0.26), being self-employed or a manager (OR: 0.32; 95% CI: 0.29-0.35), being a skilled or unskilled worker (OR: 0.45; 95% CI: 0.42-0.48). Foreign citizenship in a country outside Europe was not significantly associated with A&E department and/or IFM contact due to adult violent victimization (OR: 1.08; 95% CI: 0.96-1.22).

Study 5

Objective

1. To describe the completeness of A&E department data for the illumination of the frequency of recorded violence in Odense Municipality.

Methods and material

Included were all victims of violence from the Odense Municipality attending the A&E department at OUH and/or recorded by Odense Police due to violent victimization occurring in the period from 1 March 2003 to 29 February 2004. Data from the A&E department and the police were compared and the completeness of data was evaluated by estimating the proportion of all registered violence (by both the A&E department and the police) that was registered at the A&E department and by the police in the community.

Results

In the one-year study period 2003-2004 1403 victims of violence from Odense Municipality attended the A&E department at OUH and/or were recorded by the police. A total of 87 % of the male victims and 82 % of the female victims were registered at the A&E department (Fisher's exact, p=0.015), and 35 % of the male victims and 44 % of the female victims were registered in the police records (Fisher's exact, p=0.003). The proportion of victims attending the A&E department and also recorded by the police was 26 % for males and 31 % for females, respectively (Fisher exact, p=0.048).

Conclusion

Based on A&E department and IFM data the current study did not reveal any evidence of an increase in the incidence of deliberate interpersonal violence in the study period 1991-2002. Furthermore, we found no evidence supporting the prevailing view that injuries from deliberate interpersonal violence have become more severe. The overall recurrence proportion was 22 % and

repeat victims were responsible for 44 % of all contacts in the twelve year study period. The median time span from the first contact to the second contact with the same A&E department and/or an IFM due to violent victimization was more than 18 months and varied with age group. There were some similarities between recurrent incidents of violence. The lifetime risk of A&E department and/or IFM contact due to violent victimization was 44 % for males and 18 % for females. Merging of data from the health care system with demographic and socioeconomic data revealed that factors such as: not living with a partner, low annual household gross income, high lifetime unemployment rate, high level of household crowding, and a large age difference between victim and partner were strongly associated with adult violent victimization.

DANISH SUMMARY (DANSK RESUMÉ)

Introduktion

Afhandlingen bygger på fem delprojekter udført i samarbejde mellem Ulykkes Analyse Gruppen på Odense Universitetshospital, Klinisk Institut ved Syddansk Universitet, Retsmedicinsk Institut ved Syddansk Universitet, Center for Registerforskning ved Århus Universitet og Odense Politi.

Delprojekt 1-4

Formål

Formålet med delprojekt 1-4 var:

1. At beskrive de epidemiologiske træk ved forsætlig vold og gentagen udsættelse for forsætlig vold i Odense Kommune 1991-2002.
2. At beregne livstidsrisikoen for udsættelse for forsætlig vold i Odense Kommune.
3. At gennemføre et case-kontrol studie med henblik på at sammenligne den demografiske og socioøkonomiske status blandt voldsofre i Odense Kommune 1991-2002 med en populationsbaseret kontrolgruppe.

Metode og materiale

Inkluderet blev alle voldsofre bosiddende i Odense Kommune, der blev behandlet på skadestuen ved Odense Universitetshospital og/eller indbragt til obduktion på Retsmedicinsk Institut ved Syddansk Universitet i perioden 1991-2002. Baseret på befolkningstal beregnedes alders- og kønsspecifikke årlige incidens rater for vold. Ændringer i årlige incidens rater blev evalueret ved hjælp af Poisson regression. Ændringer i læsionstype, skadede kropsregion, brug af våben, og mortalitetsrate blev anvendt som markør for ændringer i alvorligheden af vold.

Ved hjælp af cpr-numre og ved at inkludere en fem års ”run-in” periode blev andelen af voldsofre med mere end én kontakt til skadestuen og/eller retsmedicinsk institut i perioden 1991-2002 (defineret som gengangere) beregnet. Kaplan-Meier overlevelsesanalyse blev udført med observationstid fra første til anden kontakt til skadestuen og/eller retsmedicinsk institut som følge af vold. Voldshandlingen førende til første og anden kontakt blev sammenlignet og en gentagelsesprocent for forskellige karakteristika blev beregnet.

Ud fra alders- og kønsspecifikke årlige incidensrater for førstegangskontakt med skadestue og/eller retsmedicinsk institut samt overlevelsesraten i baggrundsbefolkningen blev livstidsrisikoen for vold førende til kontakt med skadestue og/eller retsmedicinsk institut beregnet.

For hvert voldsoffer på 20 år eller mere blev fem kontroller matchede for køn, alder og dato tilfældigt udvalgt blandt baggrundsbefolkningen i Odense Kommune. Ved hjælp af cpr-numre blev demografiske og socioøkonomiske data vedrørende voldsofre og kontroller udtrukket fra Integreret Database for Arbejdsmarkedsforskning og Forebyggelsesregisteret hos Danmarks Statistik. Forskellige demografiske og socioøkonomiske modeller blev konstrueret og logistisk regressionsanalyse blev udført.

Resultater

I perioden 1991-2002 blev i alt 14.316 voldsofre inkluderet fra skadestuen på Odense Universitetshospital og/eller Retsmedicinsk Institut ved Syddansk Universitet. Den kønsspecifikke incidensrate var 9,9 (95 % CI: 9,7-10,1) per 1000 indbyggere/år for mænd og 3,4 (95 % CI: 3,3-3,5) per 1000 indbyggere/år for kvinder. For mænd faldt incidensraten signifikant og for kvinder var incidensraten uændret i perioden (Poisson regression, p=0,001 og p=0,588). For både mænd og kvinder steg andelen af lette skader (nonparametrisk test for trend, p=0,01), medens andelen af knoglebrud og dybere læsioner faldt i perioden for både mænd (nonparametrisk test for trend, p=0,01 and p=0,02) og kvinder (nonparametrisk test for trend, p=0,02 og p=0,03). Tre procent af voldsofrene havde skader forårsaget af knive og 0,4 havde skade forårsaget af skydevåben. Andelene var uændrede i undersøgelsesperioden (nonparametrisk test for trend, p=0,91 and p=0,94).

I alt 22 % af voldsofrene havde mere end én kontakt med skadestuen og/eller Retsmedicinsk Institut i den 12-årige undersøgelsesperiode. Gengangere var ansvarlige for 44 % af alle kontakter på grund af vold og medianantallet af kontakter blandt gengangere var 2 (spændevidde 2-25). Mediantiden fra første til anden kontakt var 1,75 år (0-11,44 år) for mænd og 1,64 år (1,00-9,91) for kvinder. Mediantiden faldt med stigende aldersgruppe. I alt 79 % af gengangerne oplevede anden voldsepisode inden for 4 år efter den første. Sytten procent af mændene og 7 % af kvinderne udsat for vold med brug af våben ved første voldsepisode oplevede også skade med brug af våben ved anden voldsepisode. Alvorlige læsioner som knoglebrud og dybere læsioner forekom med gentagelsesprocenter på 28 % og 19 % hos mænd og 23 % og 25 % hos kvinder.

Den beregnede livstidsrisiko for vold var 0,440 (95 % CI: 0,438-0,442) blandt mænd og 0,180 (95 % CI: 0,178-0,181) blandt kvinder. Blandt unge (15-24 år) var den kumulerede risiko 0,192 (95 % CI: 0,188.0,195) for mænd og 0,048 (95 % CI: 0,046-0,051) for kvinder.

Demografiske og socioøkonomiske risikofaktorer stærkest associeret med udsættelse for vold blandt voksne førende til skadestue og/eller retsmedicinsk kontakt var: ikke samboende med en partner (OR: 2,93; 95 % CI: 2,74-3,13), årlig indkomst på mindre end 10,000 € (OR: 2,38; 95 % CI: 2,16-

2,63), høj forekomst af livstidsarbejdsløshed (OR: 1,92; 95 % CI: 1,82-2,02), årlig indkomst mellem 10,000 € og 19,999 € (OR: 1,87; 95 % CI: 1,71-2,04), mindre end 24 m^2 per beboere i husstand (OR: 1,86; 95 % CI: 1,68-2,05), aldersforskel til partner på fem år eller mere (OR:1,56; 95 % CI: 1,43-1,69) og at være pensionist (OR: 1,49; 95 % CI: 1,36-1,63). Faktorer stærkest negativt associeret med vold blandt voksne førende til skadestue og/eller retsmedicinsk kontakt var: at være studerende (OR: 0,23; 95 % CI: 0,20-0,26), at være selvstændig eller leder (OR: 0,32; 95 % CI: 0,29-0,35), og at være faglært eller ufaglært arbejder (OR: 0,45; 95 % CI: 0,42-0,48). Udenlandsk statsborgerskab fra et ikke-europæisk land var ikke signifikant associeret med udsættelse for vold blandt voksne (OR: 1,08; 95 % CI: 0,96-1,22).

Delprojekt 5

Formål

Formålet med delprojekt 5 var:

1. At beskrive kompletheden af skadestuedata til at belyse forekomsten af registreret vold i Odense Kommune.

Metode og materiale

Inkluderet blev alle voldsofre fra Odense Kommune behandlet på skadestuen ved Odense Universitetshospital og/eller registeret hos Odense politi på grund af udsættelse for vold i perioden fra 1. marts 2003 til og med 29. februar 2004. Data fra skadestue og politi blev sammenlignet med hensyn til komplethed. Kompletheden blev beregnet af henholdsvis skadestueregistreret og politiregistreret i forhold til al registeret vold (skadestue og politi) i Odense Kommune

Resultater

I den etårige periode blev i alt 1403 voldsofre fra Odense Kommune behandlet på skadestuen ved Odense Universitetshospital og/eller registeret hos Odense politi. I alt 87 % af mændene og 82 % af kvinderne blev registreret på skadestuen (Fishers eksakt, p=0,015), og 35 % af mændene og 44 % af kvinderne blev registreret hos Odense politi (Fishers eksakt, p=0,003). Andelen af voldsofre registreret på skadestuen, der også blev registreret hos Odense politi, var 26 % blandt mænd og 31 % blandt kvinder (anmeldelsesprocenten) (Fishers eksakt, p=0,048).

Konklusion

På baggrund af skadestuedata og data fra Retsmedicinsk Institut fandt vi ingen holdepunkter for en stigning i hyppigheden af vold i Odense Kommune eller at volden skulle være blevet mere alvorlig i perioden 1991-2002. I alt 22 % af voldsofrene havde mere end én kontakt med skadestuen og/eller retsmedicinsk institut i den 12-årige undersøgelsesperiode. Gengangere var ansvarlige for 44 % af alle kontakter på grund af vold. Mediantiden fra første til anden kontakt var mere end 18 måneder

og varierede med alderen. Livstidsrisikoen for vold førende til kontakt til skadestue og/eller retsmedicinsk institut var 44 % blandt mænd og 18 % blandt kvinder. Samkøring af skadestuedata og/eller data fra Retsmedicinsk Institut med demografiske og socioøkonomiske data viste, at faktorer som ikke samboende med en partner, lav årlig indkomst, høj forekomst af livstidsarbejdsløshed, mindre end 24 m^2 per beboere i husstanden, aldersforskel til partner på fem år eller mere og at være pensionist var associeret med udsættelse for vold blandt voksne. Omvendt var faktorer som at være studerende, at være selvstændig eller leder og høj årlig indkomst negativt associeret med udsættelse for vold blandt voksne.

CONTENTS

SUPERVISORS

1. Associate Professor, Ph.D. Jens Martin Lauritsen.
   The Accident Analysis Group, Department of Orthopaedics, Odense University Hospital, Denmark and Institute of Public Health, University of Southern Denmark.

2. Associate Professor, Ph.D. Ole Brink.
   Department of Orthopaedics, Aarhus University Hospital, Denmark.

3. Senior Consultant, Ph.D. Ole Skov.
   The Accident Analysis Group, Department of Orthopaedics, Odense University Hospital, Denmark.

4. Director, Professor, DMSc. Preben Bo Mortensen, National Centre for Register-based Research, University of Aarhus, Denmark.

1. PREFACE

My interest in injury epidemiology and injury prevention started in medical school when I became a research fellow with the Accident Analysis Group at Odense University Hospital. After graduating as a medical doctor from the University of Southern Denmark in 1996 I continued my research career with the Accident Analysis Group parallel to my work as a physician in various hospitals.

The foundation for this thesis was laid in the spring of 2000 as I became resident at the Department of Orthopaedics at Odense University Hospital. The basic idea behind the thesis was created by senior consultant orthopaedic surgeon Ole Skov and later assistant professor Jens Martin Lauritsen who both encouraged me to take up violence as a whole new research area for the Accident Analysis Group. In December 2002 the study was approved by the University of Southern Denmark as a PhD-study and with a three-year scholarship at the Institute of Clinical Research.

It is my hope that this thesis will lead to a new and better understanding of the extent of and development in violence in the Municipality of Odense. Furthermore, I hope that the thesis will give new and further insight into the epidemiology of deliberate interpersonal violence and the phenomenon of repeat violent victimization and also into the demographic and socioeconomic risk factors of violent victimization seen from the perspective of an Accident and Emergency department and an Institute of Forensic Medicine. The insight should help to define factors contributing to violence which may prove helpful in future preventive strategies.

The thesis is orally defended December 15, 2006 at The Faculty of Health Sciences, University of Southern Denmark.

Odense, 2006

Christian Færgemann
christian.faergemann@ouh.regionsyddanmark.dk

2. ACKOWLEDGEMENTS

I am grateful to many people for their contributions. My thanks go to:

- My main supervisor, assistant professor Jens Martin Lauritsen at the Accident Analysis Group, for his constant interest and competent and safe guidance of me around the many pitfalls of the research process. Especially, I am very grateful for his thorough way of discussing my work and his ability to clarify texts.
- My co-supervisor, assistant professor Ole Brink, for his encouragement and creative proposals and especially, his always quick and relevant response to both specific questions and to proof-reading.
- My co-supervisor, senior consultant Ole Skov, whose ideas the major part of this thesis was built on.
- My co-supervisor, professor Preben Bo Mortensen, and his staff at the National Centre for Register-based Research for thorough supervision and for rewarding and unproblematic cooperation
- The staff at the Accident Analysis Group, consultant orthopaedic surgeon, and head of department Niels Dieter Röck, secretary Birte Landorph, secretary Marianne Fur Poulsen, and programmer Anni Ellegaard Hansen, who were all exceptionally helpful during my work.
- The secretarial staff at the Accident and Emergency department at Odense University Hospital for their competent and thorough collection of data for the study and their untiring willingness to solve problems. Especially, thanks to Lene Krogh-Nielsen, who was responsible for the collection of data for analyses in data completeness.
- Deputy chief superintendent Ebbe Krogaard from Odense Police, who was extremely helpful in collecting police recorded data for analyses of data completeness.
- Professor Jørgen Lange Thomsen and the staff at the Institute of Forensic Medicine at University of Southern Denmark for allowing me access to autopsy data and for their help regarding my review of autopsy reports.
- Statistician Henrik Støvring at the Research Unit for General Practice, University of Southern Denmark, for competent and valuable statistical supervision regarding analyses of repeat victimization and estimation of lifetime risk
- Consultant Søren Leth-Sørensen and programmer Jørn Hansen Schmidt at Statistics Denmark, who helped me merging health data with socioeconomic data from Statistics Denmark.
- Research assistant Kirsten Pagh at the Institute of Public Health, University of Southern Denmark, for English proofreading.

- The Institute of Clinical Research at University of Southern Denmark, especially secretary Dorinda Schnack for her help.
- My family, especially Anette and Juliane, for the support, patience and great interest throughout the years.
- Østifterne Insurance Company, The Danish Crime Prevention Council, The Institute of Clinical Research at the University of Southern Denmark, The Health Insurance Foundation, The Dagmar Marshall's Foundation, Grete and Sigurd Pedersen's Foundation, and The Funen County for financial support which made the study possible.

3. LIST OF PAPERS

The thesis is based on the following papers that will be referred to in the text by their Roman numerals:

I. **Faergemann C, Lauritsen JM, Brink O, Skov O**. Trends in deliberate interpersonal violence in the Odense Municipality, Denmark 1991-2002. Journal of Clinical Forensic Medicine 2006. [Epub ahead of print] .

II. **Faergemann C, Lauritsen JM, Brink O, Stovring H**. The epidemiology of repeat contacts with an Emergency department or an Institute of Forensic Medicine due to violent victimization in a Danish urban population. Accepted for publication in the Journal of Clinical Forensic Medicine.

III. **Faergemann C, Lauritsen JM, Brink O, Stovring H**. What is the lifetime risk of contact with an A&E department or an Institute of Forensic Medicine following violent victimization? Injury 2006. [Epub ahead of print] .

4. INTRODUCTION

4.1. The Municipality of Odense

The catchment area of this study is Odense Municipality located on the Island of Funen in the centre of Denmark. The municipality is geographically well defined and consists mainly of the third largest city in Denmark – the City of Odense.

In 1991 the population was 177,639 and in 2002 the population had increased to 183,628.[1] Due to the large number of educational institutions, including the University of Southern Denmark, the population is characterised by a large number of adolescents and young adults.

In 1991 and 2002 the proportion of foreign citizens in Odense Municipality was 4.0 % and 5.9 %, respectively.[2] The majority of the foreign citizens are from the other Scandinavian countries or from Somalia, Turkey, Bosnia-Herzegovina, or Iraq.[2] The unemployment rate dropped from 13.1 % in 1991 to 5.5 % in 2002.[3]

4.2. The Odense University Hospital

The open access Accident and Emergency (A&E) department at Odense University Hospital (OUH) is the only A&E department in the municipality. The A&E department covers Odense Municipality and several neighbouring municipalities with a summarized population of approximately 250,000.[2] Beside the open access unit the A&E department serves as a level 1 trauma centre which covers the southern part of Denmark with a summarized population of approximately 1.3 million.[2]

In the period 1991 to 2002 the number of injured patients attending the A&E department increased from 34,161 to 36,820.[4,5] In the same period the number of attendances due to injuries from Odense Municipality decreased from 25,926 to 24,760. Appendix A shows the distribution of all attendances to the A&E department in 2002. Approximately 350 trauma patients are admitted to the trauma centre annually, and approximately 110 of these are severely injured patients (Injury Severity Score≥15).[6]

The patient registration system includes self-reported information coded with the NOMESCO classification of external causes of injuries.[7] All registration is made by trained staff. Trained physicians determine the diagnoses according to the ICD system.[8,9] Before 1994 the ICD8 codes were used with a maximum of three diagnoses for each patient, and from 1994 and onward the newer ICD10 codes have been used with a maximum of five diagnoses for each patient.

4.3. The Institute of Forensic Medicine

As the only institution of its kind in the municipality the Institute of Forensic Medicine (IFM) at the University of Southern Denmark (SDU) covers both Odense Municipality as well as the entire southern part of Denmark. In Denmark deaths from deliberate interpersonal violence are subject to a detailed medicolegal autopsy at the IFMs. Annually, about 200 medicolegal autopsies are carried out at the SDU and approximately ten of these are victims of deliberate interpersonal violence.

4.4. The Danish Civil Registration System

Since 1968 all people living in Denmark have been registered according to the Danish Civil Registration System – a nationwide register administered by the Central Office of Civil Registration located under the Ministry of the Interior and Health.[10] Central in the Danish Civil Registration System is the civil personal identification number – the cpr-number. At birth or at immigration to Denmark all people attain a 10-digit cpr-number which is unique and follows each individual for his/her entire life and after death. The first six digits of the 10-digit code contain information about the day, month, and year of birth, whereas the last four digits comprise a code. Additionally, the last digit is gender specific. The Danish Civil Registration System, which in addition to the cpr-numbers contains information about names, home addresses, immigration and emigration, marital status, and links to parents or children, are accessible for research purposes.

One of the key services of the Central Office of Civil Registration is the extraction of individuals for research purposes e.g. for cross-sectional surveys or for random selection of controls for case-control studies.

4.5. Defining violence

In the World Health Organisation's (WHO) "World Report on Violence and Health" a wide definition of violence has been stated:[11]

> *"The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation".*

This definition covers a broad range of types of violence, such as deliberate interpersonal violence, sexual abuse, self-harm, psychological harm, threats etc. However, in this study the definition has been limited to dealing with deliberate interpersonal physical violence excluding self-harm, psychological harm, and threats etc. In other words, violence in this thesis is defined as a behavior by which a person or persons deliberately inflict physical injuries on another person.

4.6. Violence on the global level

Violence is among the leading causes of death worldwide for people aged 15-44 years.[11] Additionally, more people are injured or suffer other serious health consequences as victims, perpetrators, or witnesses of violence. In 2002 the WHO launched "The World Report on Violence and Health", the first report of its kind to address violence as a global public health problem.[11] The report also stated several recommendations for reducing violence. In addition to the report the WHO launched the "Global Campaign for Violence Prevention".[12] The campaign aims to promote discussion and debate about violence, and offers concrete ways of implementing the World Report's recommendations.

4.7. Violence on the national level

Also on the national level violence has been subject to increased interest. Already in 1993 the Danish government launched a national plan which aimed to reduce interpersonal violence.[13] The plan contained 33 different initiatives and focused on the need for more research and better statistics.

Compared to many other western countries Denmark may be considered a low-risk country when it comes to the risk of violent victimization. According to the Danish National Board of Health approximately 19,000 patients attend the A&E departments annually as a result of injuries from interpersonal violence.[14] Based on the population counts (population: 5.4 million) the overall incidence rate of violence is approximately 3.5 per 1000 population/year. The mortality rate of violence is approximately 1 per 100,000 population/year which is about 1/10 of the overall global mortality rate of violence but similar to mortality rates of violence in other established market economies excluding the US.[15,16]

Nevertheless, interpersonal violence has become one of the main topics in the Danish media. Often the Danes get the impression that Denmark is a very violent country where not only the frequency of violence has increased, but where also the lesions from violence have become more severe. In Denmark, as in many other countries, crime statistics have supported this growing public concern by showing an increase in the frequency of police reported violence.[17] In a Danish cross-sectional survey 42.2 % of the females and 9.4 % of the males avoid empty or desolate parts of cities because of an assumed risk of exposure to violence or sexual assault.[18]

4.8. Violence in the Odense Municipality

On the local level Odense Municipality has a reputation of being a specifically violent place where insecurity and fear of becoming victimized are feelings frequently shared by the population.[19] According to a local poll half of the population is scared of going about in the inner city during the night time because of an assumed risk of exposure to violence.[20] Data from the crime reports support the fear of becoming victimized showing a 50 % increase, from 579 to 868, in the number of police reported incidents of violence in the period 1991 to 2002.[17] In contrast to the fear of becoming victimized a previous study based on violence registered at the A&E department in Odense Municipality has shown a significant decrease in the overall annual incidence rate from 1988 to 1996.[21]

4.9. Defining repeat violent victimization

In criminological literature the term repeat victimization is used to describe the repeatedly occurring episodes of different types of crime. Restricting the term to victims (people) only is inappropriate

because a repeatedly victimized target can be a business, a vehicle, a household, a building with several households, or a person. However, for this thesis the term repeat violent victimization is used with referral to the repeatedly occurring episodes of deliberate physical interpersonal violence against a person inflicted by another person. The perpetrator may or may not be the same.

Repeat contact with an A&E department due to deliberate interpersonal violence is a phenomenon well known by those who work in A&E departments. From the epidemiological point of view the phenomenon is difficult to deal with. Furthermore, differences in the terminology and the definitions make comparisons between different studies difficult. For this study the following definitions were used:

Individual:	A person characterised by a unique identifier, the cpr-number. The number of individuals equals the number of different cpr-numbers.
Incident:	An incident of violence leading to one or more contacts with the A&E department and/or the IFM.
Contact:	Contact with the A&E department and/or the IFM due to injuries from violent victimization.
Repeat victim:	An individual with more than one contact with the A&E department and/or the IFM due to violence in the study period.
Non-repeat victim:	An individual with only one contact with the A&E department and/or the IFM due to violence in the study period.
Index contact:	The first contact of each individual with the A&E department and/or the IFM due to violence in the study period.

In some studies a distinction is made between different types of repeat victimization such as chronic and multiple victimization.[22] Multiple victimization is often defined as victimization that occurs more than once in a single study period and is indicative of the intensity of victimization within a limited time period for a particular individual.[22] Chronic victimization is often defined as victimization that occurs in more than one study period.[22] In the present study we do not discriminate between multiple and chronic victimization.

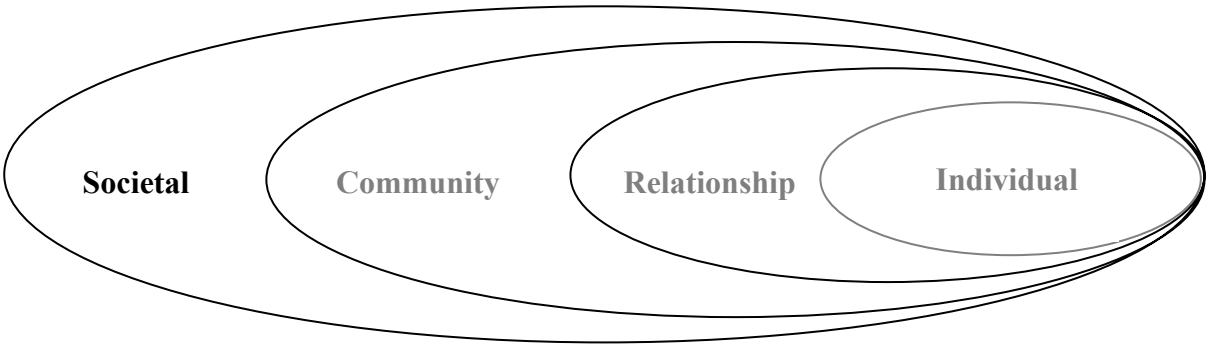
4.10. Risk factors for violent victimization

No single factor explains why some individuals are victimized and why violence is more prevalent in some communities than in others. In the 1970s an ecological model was introduced to help

understand the multifaceted nature of violence.[11] The model explores the relationship between individual and contextual factors and considers violence the product of multiple levels of influence on behaviour (Figure 4.1).

The first level in the model seeks to identify biological and personal history factors such as impulsivity, substance abuse, low education, unemployment, prior history of aggression etc. The second level explores how proximal social relations increase the risk of violent victimization or perpetration of violence such as relations with peers, partner or family members. The third level examines the contexts in which social relationships are embedded such as schools, workplaces, and neighbourhoods, and seeks to identify the characteristics of the settings that are associated with violence. The final level of the model examines the larger societal factors that influence the frequency of violence such as cultural norms and attitudes towards violence in the society.

Figure 4.1. Ecological model for understanding violence.



While some risk factors may be unique to a particular type of violence, the various types of violence generally share a number of risk factors. Furthermore, the different layers of the model may interact. For example, a victim's unemployment and social isolation may be related to high levels of unemployment and social isolation in the community. This thesis only deals with the first level of the model – the individual risk factors.

4.11. Data sources of violence

Studies of violence are mainly based on three different data sources: 1) Data from the police and judicial system, 2) data from cross-sectional surveys, and 3) data from the health care system – hospitals, general practitioners, and/or institutes of forensic medicine.

4.11.1. Police reported violence

Statistics based on police reported violence have often been perceived as a good and reliable measure of the prevalence of violence in the society and of the changes in the level of violence over time. However, several papers have documented the limitations of police reported violence as the sole data source in violence research because of high levels of unreporting.[23-29] Decisions to report crimes to the police depend on a wide range of factors, which include fear of reprisals, a continuing relationship with the offender, hostility towards the police, a perception that the behaviour did not constitute a crime, and inability to identify the offender. Furthermore, police reporting depends on the circumstances surrounding the violence, and on the age and gender of the injured person.[23,26]

Previous international studies have shown that between 14 % and 46 % of all victims attending A&E departments are known to the police.[23,25-27]

Danish crime statistics have shown a steadily increasing frequency of police reported "violence against the person" from 7985 in 1991 to 10,225 in 2001.[17] The steadily increasing volume of violence recorded by the police in many countries may reflect a greater public willingness to report, and a recognition of violence as being unlawful. In previous Danish studies the overall percentage of A&E department and/or IFM registered victims of violence who were also recorded by the police increased from 16 % to 32 % in the period between 1981-1982 and 1993-1994.[30-32] A previous Danish study has documented conflicting trends between police reported data and data from the health care systems.[29]

Shepherd et al. conclude that police records of violence are a product of police surveillance, targeted activity, and recording practice, which should not be used as a measure of underlying trends in violence.[33]

4.11.2. Surveys of violence

The number of surveys of violence is large. The majority of these studies are cross-sectional surveys describing the proportion of respondents exposed to violence at least once in their lifetime from birth until sampled in a cross-sectional study defined as the lifetime prevalence or lifetime exposure. Other studies describe the yearly prevalence of exposure to violence. Unfortunately, cross-sectional surveys may have weaknesses. First of all differences in methodology and different definitions or cultural notions of violence make a comparison of the studies less meaningful.

Especially where victims and offenders know each other, surveys may underestimate/underreport the violence. Various other factors may stand in the way of accurate answers: a respondent may fabricate an offence, fail to realise that an incident meets the term of the question, remember the incident but think it happened before the reference period, remember an earlier incident as being within the reference period, or simply forget a relevant incident.

4.11.3. Violence registered in the health care system

The third source of information on violence in the community is the registration of assault victims treated in the health care system. Scientists have been increasingly aware of the potential of the health care system as a data source for violence research and surveillance.[34] Shepherd et al. have stated that A&E department data should be used as an objective indicator of violence related harm and to inform local violence prevention.[33] Studies have indicated that the vast majority of victims are being treated at A&E departments and very few at the general practitioners.[25,31]

A&E data can provide valuable information about hotspots and help target community safety and crime reduction interventions. The data can also be used to measure the success or failure of interventions. A review by Shepherd emphasizes that A&E data can be used to direct police interventions and suggests that A&E departments and the police collaborate to prevent community violence.[35] Unfortunately, the registration of violence in the A&E departments is fragmentary and often limited to specific institutions, wards, violence typology, or to a limited time period which may reduce the impact of the results. Furthermore, A&E department data relate to the acute treatment of injuries caused by violence, and not all the other consequences and complications that violence may have.

Probably only a minority of assault victims seeks medical attention or report to the police. Unfortunately, no reliable information is available about the frequency of violence, which is unknown to the medical and police authorities. Changes in the proportion of assault victims seeking medical treatment over time clearly represent a factor of uncertainty using health care data to estimate the level of violence in a community and its changes over time. A further complication is the finding of some studies that attendance rates to A&E departments following injuries depend on factors such as distance to the A&E department and ethnicity.[36,37] It is also a problem that A&E department data on violence generally lack completeness: location where the incident took place, details of the perpetrator, and the relationship between the injured and the perpetrator are usually not recorded.[33] Additionally, violence against children or sexual violence may not be disclosed.[33]

5. PREVIOUS STUDIES

The following review of studies based on unselected A&E department data includes only those conducted from 1980 and onward.

5.1. Previous studies based on unselected A&E department data

5.1.1. Previous Danish studies

In a 6 months prospective study of 519 victims attending an inner city A&E department in Copenhagen 1980-1981 victims of violence represented 3.5 % of all attending casualties.[38] Five per cent of the victims had injuries due to firearms or knifes and 9 % due to glass bottles.

Two previous 6 months prospective studies from the A&E department at Esbjerg County Hospital have been published.[39,40] The 1981 study included 236 victims and violence represented 3 % of all attending casualties.[39] In the second Esbjerg study 10 years later 509 victims were included representing 4.1 % of all attending casualties.[40] The overall incidence rate was 9 per 1000 population/year. The incidence rate was 13.4 per 1000 population/year and 4.7 per 1000 population/years for males and females, respectively.

Four prospective one-year studies have been conducted in Aarhus.[28-32,41-47] The first study, the 1981-1982 study, included 1639 victims from two A&E departments and from the IFM.[30,41-43] Violence accounted for 3.4 % of all casualties attending the A&E departments. The incidence rate was 10.6 per 1000 population/year for males and 3.0 per 1000 population/year for females. Three per cent of the victims had injuries due to stabs or cuts with knifes and 6 % due to glass or bottles. The second Aarhus study included 1874 victims from 1987-1988.[31,44-46] The overall pattern of violence was unchanged since the 1981-1982 study.

In the third study data of 1710 victims was collected from two A&E departments, the IFM, and the police 1993-1994.[28,29,32,47] The incidence rate had decreased significantly from 10.6 to 8.6 per 1000 population/year for males and from 3.0 to 2.5 per 1000 population/year for females. Violence represented 2.8 % of all casualties. Four per cent of the victims had injuries due to knifes, 0.8 % had injuries due to firearms, and 9 % had injuries due to glass or bottles. The severity of the injuries was unchanged.

The latest Aarhus study, the 1999-2000 study, included 1496 victims from two A&E departments and the IFM.[48,49] The overall incidence rate had decreased to from 6.5 in 1981-1982, 7.5 in 1987-1988, 5.5 in 1993-1994 to 4.6 per 1000 population/year. Victims with foreign ethnic origin were significantly higher represented than in previous studies. The character and severity was still unchanged.

In a 12 months study covering the period 1985-1986 Breiting et al. included all victims of violence attending three hospitals and the IFM in Copenhagen.[50-52] Overall 1316 victims were included from the A&E department, representing 1.8-2.3 % of all casualties, and 50 victims were included from the IFM. The annual incidence rate varied between 3.3 and 7.6 per 1000 population at the hospitals. Firearms were used against 0.3 % of the victims.

A single previous study from the Odense Municipality has been published.[21] The study included all victims of violence attending the A&E department at OUH from 1988 to 1996. The study revealed a significant decrease in the overall incidence rate from 8.4 per 1000 population/year in 1988 to 5.7 per 1000 population/year in 1996.

5.1.2. Previous international studies

In 1986 Shepherd et al. conducted a six months prospective study of all victims attending the A&E department at the Bristol Royal Infirmary.[53] Overall, 294 victims were included. Ten per cent of the victims suffered from injuries due to sharp objects, 9 % from injuries due to glass, and 0.7 % from injuries due to firearms.

Two smaller studies from London, England, including 201 and 425 victims attending A&E departments 1986-1987 have been published.[27,54] In the study by Driscoll et al. victims of violence represented less than 1.5 % of all attending casualties. In both studies 7-15 % suffered from injuries due to knifes and 6-9 % from injuries due to glass.

In a Welsh one month prospective study of victims attending the A&E department at Cardiff Royal Infirmary violence represented 2.3 % of all new attendances.[55] In a similar English study of 214 consecutive victims attending an A&E department in Surrey victims of violence represented 3.3 % of all attending casualties.[56] Respectively, 9 % of the males and 3 % of the females suffered from stab injuries.

In a two months prospective study of 235 victims attending a Scottish A&E department in 1995 victims of violence constituted 2.4 % of all attendances.[57] Knifes or other sharp blades were used in 23 % of the attacks, broken glass or bottles in 15 %, and baseball bats in 4 %. About 44 % of the victims had been assaulted previously within the past five years.

In 1998-1999 Howe et al conducted a twelve months retrospective study of all victims attending an English District General Hospital A&E department in Lancashire.[58,59] Overall 735 victims were included representing 1.7 % of all attendances. The overall annual incidence rate was 4.67 per 1000 population/year. In another English study of 6034 victims attending an A&E department violence represented 4.7 % of all casualties.[60]

In a large register-based English study of all A&E department attendances and hospital admissions in West Midlands 1999-2000 17055 victims were included from the A&E departments representing 1.9 % of all attendances.[61] The overall incidence rate was 5.1 per 1000 population/year (7.2 for males and 2.8 for females). In another larger register-based study of 353442 violence related attendances to 58 A&E departments in England and Wales 1995-2000 the gender specific annual incidence rate was 7.5 and 2.6 per 1000 population/year for males and females, respectively.[62] A significant linear increase in the annual incidence rate was found among females aged 11-17 years in the study period.

In a single Irish study of 122 victims attending an urban A&E department weapon were used in 44.3 % of the assaults.[63] Nineteen per cent were foreign citizens.

In a study based on the Norwegian National Injury Sample Register injuries due to violence represented 2.4 % of all injuries among females and 5.5 % among males.[64] The overall incidence rate was 3.8 per 1000 population/year showing a 15-20 % reduction in the study period 1990-1997. Another Norwegian study all victims of violence treated in the Oslo Legevakt 1994 violence represented 2.8 % of all attendants.[65] Six per cent had injuries due to cut or stab with knifes, 0.5 % injuries due to firearms, and in 5 % injuries were due to broken glass.

Steen et al. conducted a prospective study of 1803 assault victims attending the A&E department in Bergen, Norway 1994-1996.[66,67] Assault victims accounted for 1.3 % of all consultations. Knifes were used in 3 % of the incidents, glass or bottles in 7 %, and firearms in 0.2 %.

In a Swedish study of victims attending an A&E department in Stockholm during a 12 months period in 1992-1993 8 % of the victims suffered from injuries due to stab or cut with a knife and 0.8 % had injuries due to shotguns.[68] A report from Umeå, Sweden, revealed a slight increase in the

annual incidence rate of A&E department attendances due to violence from 3.6 to 4.0 per 1000 population/year among males and from 0.7 to 1.1 per 1000 population/year among females in the time period 1985 to 2002.[69] Two per cent of the males suffered from stab or cut injuries from a knife, and 5 % of the males and 2 % of the females suffered from injuries due to glass bottles.

A single Spanish study by Nuñes et al. studied 1100 victims attending an A&E department in Santa Cruz de Tenerife, Canary Islands.[70] Assault represented 1.4 % of all casualties. Three per cent of the victims suffered from injuries due to cut or stab with knifes and 0.4 % from injuries due to firearms.

5.2. Previous studies of repeat violent victimization

5.2.1. A&E department studies of repeat violent victimization

In previous studies based on unselected A&E department data the proportion of repeat victims and repeat visits due to violence varied according to different observation lengths. In the 1993-1994 Aarhus study the one year proportion of repeat victims was 5 %.[28]

In studies of victims attending two London A&E departments 28-34 % had been assaulted previously.[27,54] Wright et al. found in a Scottish study that among 235 victims 44 % had been assaulted previously within the last five years.[57] Findings from the US Philadelphia Injury Prevention Program have indicated that repeat injuries account for 10 % of all visits to A&E departments for injuries and 27.7% of these are caused by interpersonal violence.[71]

In a prospective survey of A&E department records from eleven hospitals in the US Schwarz et al found that those who died from intentional injury were more likely to have had a previous intentional injury, and the likelihood of future injury increased with the number of past traumas.[72]

Morrissey et al studied the frequency of recurrent penetrating trauma in an US A&E department.[73] In five year follow-up 32.6 % of the victims had sustained one or more recurrent episodes of penetrating traumas. Males and blacks were heavily overrepresented among those with recurrent traumas.

In an US A&E department study Buss et al. found that, compared to one-time victims, repeat victims were even more likely to be poor, to be minorities, to have witnessed violent attacks, and to have been threatened during the prior year, and to generally carry a weapon.[74] Of the 378 victims

included in the study 39 % reported previous victimization. By contrast, 18.9 % of the medical records indicated repeat urban trauma. In combining self-report and medical records, prior victimization became 42.9 %. Nearly three fifths (61.7 %) of those interviewed were victimized within four years of their recent incident.

Moscovitz et al. conducted a retrospective, medical record-based, case-control study of 200 US A&E department patients aged 17 years or more with assault injuries and 200 matched controls presenting with medical or surgical problems unrelated to assault.[75] The overall four year rate of previous assault injury was 26 % and did not differ between cases and controls.

Shepherd et al. conducted a case-control study of 49 victims of violence attending an UK A&E department.[76] The controls were selected among acquaintances of the victims. The study revealed a significantly larger number of previous violence among the victims than among the controls (44.9 % vs. 34.7 %). The mean number of previous victimizations was 4.3 among current victims and 1.5 among controls.

Poole et al. studied the prior trauma experience of 200 consecutive patients admitted to a US level 1 trauma centre.[77] The study showed that trauma patients were more likely to have had previous hospitalization for a prior injury within the previous five years than either emergency patients or elective surgery patients. There was no difference in the probability of a prior trauma admission between patients admitted with intentional or nonintentional injuries.

5.2.2. Level 1 trauma centre studies of repeat violent victimization

In a prospective US level 1 trauma centre study Goins et al. found that among all victims of assaultive injuries admitted over a 4 months period 45 % had previous episodes of assaultive injuries.[78] A parallel retrospective chart review of 232 victims requiring laparotomy for penetrating abdominal traumas over a 4 year period revealed that 33 % had previous admissions to the hospital due to assault. Additionally, the study revealed a significantly higher unemployment rate among those with recurrent episodes than among those without. In a similar US level 1 trauma centre study of stab or gunshot wounds 44 % experienced at least one recurrent trauma in the study period.[79] The average number of incidents per repeat victim was 2.6. The repeat victims had a higher percentage of gunshot wounds than the non-repeat victims. Unemployed represented 86 % of the repeat victims.

Tellez et al. conducted a retrospective study of 552 intentional trauma admissions to an US level 1 trauma centre among youths (<25 years) during a three year period.[80] The study revealed that 16 % have had prior intentional injuries and 94 % of these had suffered their previous injury within the previous five years. The median length of time between the index and the previous injury was 14 months.

In a case-control study from a US level 1 trauma centre 200 repeat victims of violent assault were compared to age and gender matched controls admitted for reasons unrelated to violent injury.[81] Prominent risk factors for repeat victimization were African-American ethnicity, being single, living in public/subsidized housing, poor education, unemployment, lack of medical insurance, low income, current drug use, an a positive test for psychoactive substances on admission to the hospital. Those raised by only one parent/extended family and those previously convicted and sentenced to imprisonment were overrepresented among repeat victims.

5.2.3. Other studies of repeat violent victimization

A prospective 12 months follow-up study of all trauma admissions in New Zealand revealed that patients discharged from hospital following injuries due to assault had a 39.5 times higher incidence rate of subsequent admission due to assaultive trauma than a control group consisting of the background population.[82] A similar US cohort study of patients discharged from hospital following injuries related to assault were compared to patients discharged following non-injuries.[83] Those initially admitted for treatment following assault were found to be at greater risk of subsequent treatment for assault than those admitted for non-injuries. Additionally, a cross-sectional study of patients presenting to an urban US A&E department showed that the odds of violence related injury was increased three-fold among persons with a history of victimization from an intimate partner.[84]

In a case-control study of 820 victims of gunshot injuries in Sweden 1972-1992 and 820 population-based controls a three-fold higher frequency of all kinds of injuries was found among the victims than among the control (34.9 % vs. 12.7 %).[85] When the external causes of injury were divided into subgroups both suicide/self-inflicted injury and homicide/violence were more common among the victims.

5.3. Previous studies of lifetime risk of violent victimization

A previous single study from the Odense Municipality has estimated the lifetime risk of violence as the cumulative incidence proportion by cumulating the age specific annual incidence rates.[21] The study revealed a lifetime risk of 45 % for males and 21 % for females.

Projections of the likelihood of violent victimization during the lifetime based on US National Crime Survey have been made by Koppel.[86] Koppel's estimates were based on age- and gender-specific rates of victimization beginning at age 12 and age-specific life expectancies. The study revealed that for the total US population 89 % of the males and 73 % of the females will become victims of violent crimes.

Numerous papers have described the lifetime prevalence or the lifetime exposure to violence. These papers are cross-sectional prevalence studies describing the proportion of respondents exposed to violence at least once in their lifetime from birth until sampled for the study. Unfortunately, differences in methodology and different definitions or cultural meanings of violence make a comparison of these different studies less meaningful. These prevalence studies are population-based or based on selected A&E department data.

5.3.1. Population-based surveys

In a Danish survey from the National Institute of Public Health of adults aged 18 years or more 34.2 % of the males and 24.2 % of the females had been exposed to violence or threats of violence at least once in their life.[18] In a survey from the Danish National Institute of Social Research 36 % of the males and 19 % of the females had been exposed to violence in their lifetime.[87] Another Danish survey revealed a lifetime prevalence of severe violence (being hit, kicked, thrown against an object, strangled, or assaulted with knife/firearm) of 20.5 % for males and 11.6 for females.[88] In a cross-sectional survey from Greenland 47.5 % of the males and 46.8 % of the females had been victims of violence at least once in their lifetime.[89]

In a similar population-based American survey of adults aged 18 years or more half of the respondents reported being a victim of some form of interpersonal violence at least once in their lifetime.[90] Perez-Smith et al. found in an American study of inner-city youth aged 14 to 19 years that 73 % of the boys and 26 % of the girls had been victims of violence.[91] In other American studies the lifetime exposure to violence among young adults ranged from 70 % to 82 %.[92-94]

5.3.2. Surveys based on A&E department data

Numerous surveys dealing with the lifetime prevalence of domestic or intimate partner violence based on A&E department populations have been published. In surveys from the US or Canada the lifetime prevalences was 12 % for violence against males and 34-58 % for violence against females.[95-102] In similar studies from UK or New Zealand the lifetime prevalences were between 8.5 % and 22.4 % for violence against males and between 21 % and 44 % for violence against females.[103-106] A single survey of intimate partner violence against women based on patients visiting gynaecology clinics in the five Nordic countries revealed lifetime prevalences of any physical abuse of between 37.5 % and 66.2 % (53.6 % in Danish woman).[107]

5.4. Previous studies of individual risk factors of violent victimization

The following review of previous studies focuses only on individual factors that increase the likelihood of becoming a victim of violence corresponding to the inner layer of the ecologic model in section 4.10. Additionally, the review mainly focuses on A&E department or IFM studies.

Figure 5.1 summarizes the individual conceptual domains relevant to the study that may increase the likelihood of becoming a victim of violence based on review of previous studies.

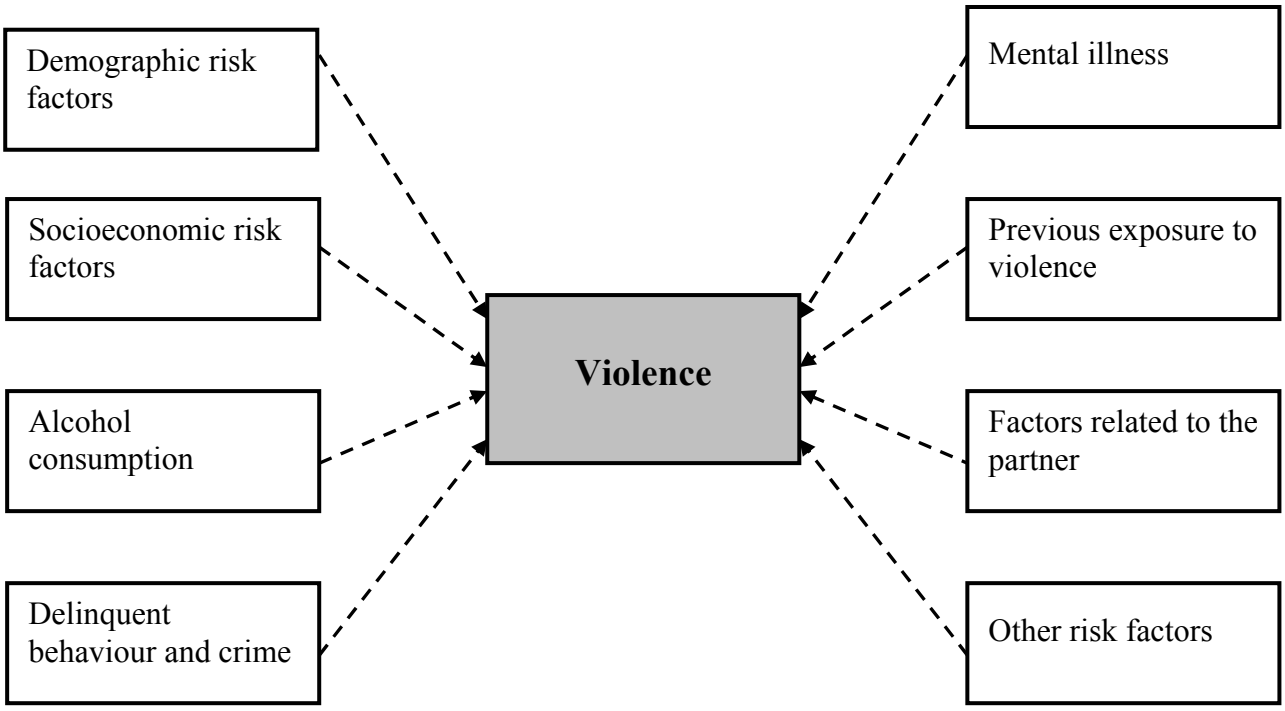
5.4.1. Demographic risk factors

Male victims, most adolescents or young adults, dominate all unselected A&E department studies of victims, with percentages of male victims above 70 % and mean or median age in the twenties or early thirties.[27,28,30,31,38-40,50,53-57,59,60,62,63,65,67-70] Age and gender seem to be the most important risk factors of violence.

Some previous descriptive papers have indicated that foreigners are overrepresented among unselected victims attending the A&E departments.[49,65] Additionally, foreign ethnic origin has been associated with more serious injuries (AIS≥2).[32] Conversely, another paper based on unselected victims attending A&E departments did not find that victims with foreign ethnic origin were overrepresented.[53] Additionally, in a population-based case-control study of risk factors for homicide in Sweden during 1978-1994 non-Nordic origin was associated with increased risk of homicide.[108] Conversely, in a case-control study of work-related violence based on the US National

Crime Victimization Survey database race/ethnicity (non-white) was associated with decreased risk of work-related violence.[109]

Figure 5.1. Summary of individual conceptual domains relevant to the study.



5.4.2. Socioeconomic risk factors

Ecological studies have demonstrated correlations between the rate of different types of violent crimes in a society and socioeconomic conditions such as the extent of material deprivation, the unemployment rate, the extent of inequality, and low social capital.[58,110-115]

In some unselected A&E department studies victims of violence are frequently living alone (never married, divorced or widowed).[38,56] Surveys have revealed associations between single marital status (never married, divorced, or widowed) and admission to hospital due to violence, exposure to work-related violence, increased risk of domestic violence or intimate partner violence, and homicide.[102,108,109,116-121] Additionally, high frequency of physical abuse of women has been found in households with more children or more household members.[120,122,123] In most previous A&E department studies victims with low socioeconomic status such as skilled and unskilled workers,

and students dominate.[28,38,39,53] The low socioeconomic attainment has been confirmed in other types of studies.[116,124] In previous A&E department studies between 12 % and 49 % of the victims are unemployed.[27,28,38,53,125] The association between violent victimization and under- or unemployment has been clearly confirmed in numerous case-control studies or cross-sectional surveys[117,123,125-127] Several studies have shown strong correlations between violence and low educational level.[102,124,128,129] Conversely, other studies have found a higher probability of being victimized among more highly educated people.[118,127,130] Also factors such as social deprivation, low income, and receipt of government monetary assistance have been associated with increased risk of violence.[117,125,128,131]

5.4.3. Alcohol consumption

Crime statistics have revealed that the level of violence in a society follows the level of alcohol intake.[132] Studies have shown positive correlations between exposure to violence and binge drinking, between violence and the total alcohol consumption, and between violence from an intoxicated person and the frequency of visiting public drinking places.[133,134] Conversely, Rossow also indicated that the more often drinking takes place in public drinking places, the less is the impact of intoxication on the likelihood of getting into a fight.[134] Any consumption of alcohol, even levels regarded as "low-risk consumption", seem to increase the likelihood of being exposed to violence.[135]

A review of A&E department studies found that victims of violence were two to five times more likely to be influenced by alcohol by the time of A&E department contact than other injury patients attending the A&E department[136]. Male victims seem to be more frequently influenced by alcohol than female victims.[137]

5.4.4. Delinquent behaviour and crime

The relation between violent victimization and major personality and behavioural factors such as antisocial behaviour, impulsiveness, and poor behavioural control has been described previously.[138,139] Injury including injuries from interpersonal violence may be one symptom of an antisocial personality that arises in childhood and persists into adulthood.[140]

Furthermore, assault patients are significantly more likely to be formally warned or convicted, and they have a higher mean number of warnings or convictions, than other injury patients.[141] In an American study of victims admitted to a trauma centre for assault related injuries 54 % had criminal records.[79]

5.4.5. Mental illness

Studies of clinical populations have indicated high rates of lifetime criminal victimization among psychiatric patients. Abuse rates as high as 81 % have been reported in studies of multiple types of adult abuse, such as physical, sexual, emotional, and verbal abuse.[142-145]

Inpatients with severe mental illness have a 2.5 times greater rate of violence criminal victimization than the background population.[146] In a Danish population-based study patients with mental illness had significantly increased rates of death by homicide.[147] A survey of persons discharged from mental hospitals who were living in board-and-home care homes showed that one third of them had been victims of crime during the proceeding year.[148]

5.4.6. Previous exposure to violence

Previous studies documenting the extent of repeat violent victimization are mentioned in section 5.2. Several studies based on A&E department data have shown that previous exposure to violence is associated with increased likelihood of future episodes of violent victimization.[72,74] Other studies based on other data from the health care systems have shown similar results.[82-85]

5.4.7. Factors related to the partner

Factors directly or indirectly related to partners have been revealed as factors associated with increased likelihood of violent victimization. High frequency of spousal physical violence was found among women who were more educated than their spouse, in couples where the wife was the only one employed, and in couples with low male socioeconomic status.[122,123,131]

5.4.8. Other risk factors

Low cholesterol levels have been associated with increased risk of violent victimization. Several studies have found significantly more violent deaths in men with low cholesterol.[149-151] It has been suggested that this association is caused by lower levels of serotonin in the brains among individuals with low cholesterol.[152]

5.4.9. Interaction of risk factors

Some individual risk factors may be unique to a particular type of violence. However, in most cases the various types of violence share a number of risk factors. For example, alcohol abuse is a risk factor for more than one type of violence. Furthermore, some risk factors may interact. For example, the aetiology of alcohol related violence is probably a combination of social, cultural, and pharmacological factors. Individuals with alcohol abuse may be influenced by a deprivated social status which in itself is a risk factor for violent victimization. Additionally, individuals with non-causation ethnic origin or individuals with mental illness may live under social conditions which are correlated to increased risk of violent victimization.

5.5. Studies comparing A&E department and police recorded data

Previous Danish and international studies have compared A&E department and police registrations of violence and described both the overlap between these data sources and the relative high proportion of victims unknown to the police.

In the previously conducted Aarhus studies the overall proportion of A&E department and/or IFM registered victims of violence who were also recorded by the police increased from 16 % to 32 % in the period 1981-1982 to 1993-1994.[30,32] The gender specific percentages increased from 14 % to 31 % and from 24 % to 37 % for males and females, respectively.[29,30] The Aarhus studies have also shown that police reported violence increased from 25 % to 58 % of all violence registered at the A&E departments, the IFM, and the police in the period 1981-1982 to 1993-1994.[49]

In a Norwegian study from Bergen the total proportion of victims recorded at the A&E department and the police were 53 % (93/175) and 62 % (109/175), respectively.[25] Overall 31 % of the victims treated at the A&E department were known to the police.

An English study has shown that 76 % of all registered violence is registered in the A&E departments.[26] Similarly, studies from England have shown that between 23 % and 46 % of all A&E department registered violence is known to the police.[23,27]

6. OBJECTIVES

6.1. Limitations of previous studies

Based on the introduction and the review of previous studies this section describes the limitations of previous studies and the need for additional information. (For references see chapters 4 and 5).

6.1.1. Frequency of and trends in violence

Compared to many other countries Denmark is thought of as a relative low risk country when it comes to violent victimization. However, Odense Municipality has got a reputation for being a specifically violent municipality. This reputation is supported by a 50 % increase in the number of police reported violence from 1991 to 2002. As several national and international studies have indicated the steady increase in the police reported violence may reflect an increasing willingness to report violence.

Previous studies have suggested that, if collected correctly, data from an A&E department can provide valuable information for evaluating the development in the frequency and the severity of violence in a community.

An often asked and, seen from the public point of view, relevant question is: "What is the risk of becoming a victim of violence?" Previous studies have attempted to answer the question by using different methods. The majority of these are cross-sectional prevalence studies describing the proportion of respondents exposed to violence at least once in their lifetime from birth until sampled for the study. The results from these studies are highly dependent on the age distribution of the sample. Additionally, differences in the definitions and cultural meaning of violence make these studies less comparable. A different strategy would be an estimation of the lifetime risk of violence leading to contact with an A&E department and/or an IFM defined as the likelihood of experiencing contact with one of these institutions due to violence at least once in a lifetime. The lifetime risk can be estimated based on the age and gender specific incidence rates of first time contacts with an A&E department and/or IFM due to violence and the survival rates of the background population. Only one previous A&E department study of violence in Odense Municipality has been conducted. In contrast to the police data the study showed a significant decrease in the overall incidence rate from 1988 to 1996. The study estimated the lifetime risk of violence as the cumulative incidence

proportion of all victims attending the A&E department including victims with recurrent incidents. The study did not estimate age and gender specific annual incidence rates or reveal whether any change in severity had occurred. Furthermore the study did not take a run-in period into account and did not censor individuals from the population at risk when they became victims of violence.

Therefore:

1. *New studies of the extent and development in the frequency and the severity of deliberate interpersonal violence in Odense Municipality based on A&E department and/or IFM data are needed.*

2. *An estimation of the lifetime risk of violence leading to contact with an A&E department and/or IFM based on age and gender specific incidence rates of first time contacts due to violence and the age and gender specific survival rates of the background population will be of great value.*

6.1.2. Repeat contacts due to violent victimization

Repeat contacts due to violent victimization is a phenomenon well known to those who work in the A&E departments. From an epidemiological point of view the phenomenon is difficult to deal with. First of all a reliable personal identifier (like the Danish cpr-number) and a long time span are needed to identify the victims with repeat contacts. Secondly, a run-in period must be taken into account to decide whether a given contact in the study period is the overall first contact or whether an earlier contact due to violent victimization has occurred prior to the study period.

No previous study based on data from A&E departments and IFMs has fulfilled all of the criteria mentioned. Very few studies had access to a reliable personal identifier such as the Danish cpr-number. Secondly, the majority of previous studies have described the frequency of repeat contacts with A&E departments in a relatively short time span (≤ five years) which limits the number of identified victims with repeat contacts. Thirdly, no previous study has taken a run-in period into account in order to identify victims with repeat contacts more correctly.

The lack of a personal identifier, the short time span, and the lack of an appropriate run-in period may all lead to misclassification of both repeat and non-repeat victims. Additionally, no previous studies have attempted to demonstrate the repetitive characteristics of recurrent incidents of violence registered in the health care system.

Therefore:

1. *Longitudinal studies of repeat victims of violence attending A&E departments and/or subjected to medicolegal autopsy at IFMs using appropriate epidemiological methodologies are needed.*

2. *Studies of repetitive characteristics of the incidents of violence leading to recurrent contacts with an A&E department and/or an IFM, which can provide important information for campaigns, are lacking.*

6.1.3. Demographic and socioeconomic risk factors

Figure 5.1 summarizes different individual conceptual domains that may increase the likelihood of becoming a victim of violence. For several of these domains it is rather difficult and also time-consuming to obtain reliable information regarding victims of violence. However, A&E departments and IFMs may serve as reliable data sources of victims.

The Danish authorities have a long tradition of data collection and data storing regarding the entire population. The data are stored in numerous national longitudinal registers and several of these are maintained by Statistics Denmark. The registers contain valuable demographic, socioeconomic, and health information as well as information about criminal convictions which has become more easily accessible for scientific purposes. Merging data about victims of violence from A&E departments and IFMs with data from the national longitudinal registers has not been done before.

By using the Danish cpr-number as a key such a register linkage may reveal new information regarding victims of violence and make comprehensive analyses of risk factors possible. However, the accessibility and the suitability of the different registers may vary. So far demographic and socioeconomic data seem to be the most easily accessible and suitable data for scientific analyses.

Therefore:

1. *The question arises: "Is it feasible to merge A&E department and IFM data regarding victims of violence with national longitudinal demographic and socioeconomic registers?"*

Several previous studies have demonstrated the importance of different individual risk factors for violent victimization. Studies of victims attending A&E departments and/or IFMs have indicated

that violent victimization is closely related to factors such as being a male, living alone, poor education, being unemployed, low income, inadequate living conditions, and ethnicity. The majority of A&E department or IFM studies are purely descriptive and the demographic and socioeconomic characteristics of the background population have not been taken into account.

A few case-control studies employing A&E department data have been published. The majority of these studies are based on small samples and/or the victims were compared to controls which were not population-based. Furthermore, very few A&E department and/or IFM studies have attempted to describe the relative importance of different demographic and socioeconomic risk factors of violent victimization leading to A&E department and/or IFM contact.

Therefore, if it is feasible to merge A&E department and IFM data regarding victims of violence with various Danish national longitudinal demographic and socioeconomic registers, then:

1. *In order to conduct comprehensive and thorough analyses of demographic and socioeconomic risk factors for violent victimization leading to A&E department and/or IFM contacts, a large register-based case-control study using population-based controls is needed.*

6.1.4. The completeness of A&E department and police recorded data

Scientists have been increasingly aware of the potential of the health care system as a data source for violence research as more victims are registered in the health care system than anywhere else. Previous Danish papers have revealed the overlap as well as the incompleteness of A&E department recorded and police recorded violence. Unfortunately, no previous study has illuminated the overlap and the incompleteness of A&E department recorded and police recorded violence in Odense Municipality.

Therefore:

1. *Information regarding the completeness of A&E department data and police recorded data in Odense Municipality is missing.*
2. *A study describing the completeness of A&E department data regarding violence registered in Odense Municipality is valuable for validating the results of analyses based on A&E department and IFM data.*

6.2. Objectives

Based on the previous section the objectives of this thesis were:

1. To describe the epidemiology of deliberate physical interpersonal violence and repeat violent victimization in Odense Municipality from 1991 to 2002 based on data from the A&E department at OUH and data from the IFM at SDU. Specifically:

    a) *To estimate age and gender specific trends in the incidence rates of violence.*
    b) *To describe trends in the severity of violence.*
    c) *To estimate the twelve year recurrence proportion of repeat contacts due to violent victimization.*
    d) *To describe the time span from the first to the second contact due to violent victimization using survival analyses.*
    e) *To describe similarities between the incidents leading to the first and second contact respectively.*
    f) *To estimate the gender specific lifetime risk of violent victimization.*

2. To describe the demographic and socioeconomic status of victims of violence attending the A&E department and/or subjected to medicolegal autopsy at the IFM compared to population-based controls using a case-control design. Specifically:

    a) *To assess the feasibility of describing demographic and socioeconomic status of victims of violence based on data the A&E department/IFM and data from national longitudinal registers.*
    b) *To describe demographic and socioeconomic risk factors for violent victimization leading to A&E department and/or IFM contacts.*

3. To describe the completeness of A&E department data for the illumination of the frequency of recorded violence in Odense Municipality. Specifically:

    a) *To describe the completeness of victims of violence registered in the A&E department compared to all A&E department and/or police registered victims of violence in Odense Municipality.*

b) *To estimate the proportion of victims of violence attending the A&E department who are also known to the police.*

7. METHODOLOGICAL CONSIDERATIONS

More specific methodological considerations, which were related to the planning of the studies, will be described in the following section.

7.1. Rating the severity of the violence (Study 1)

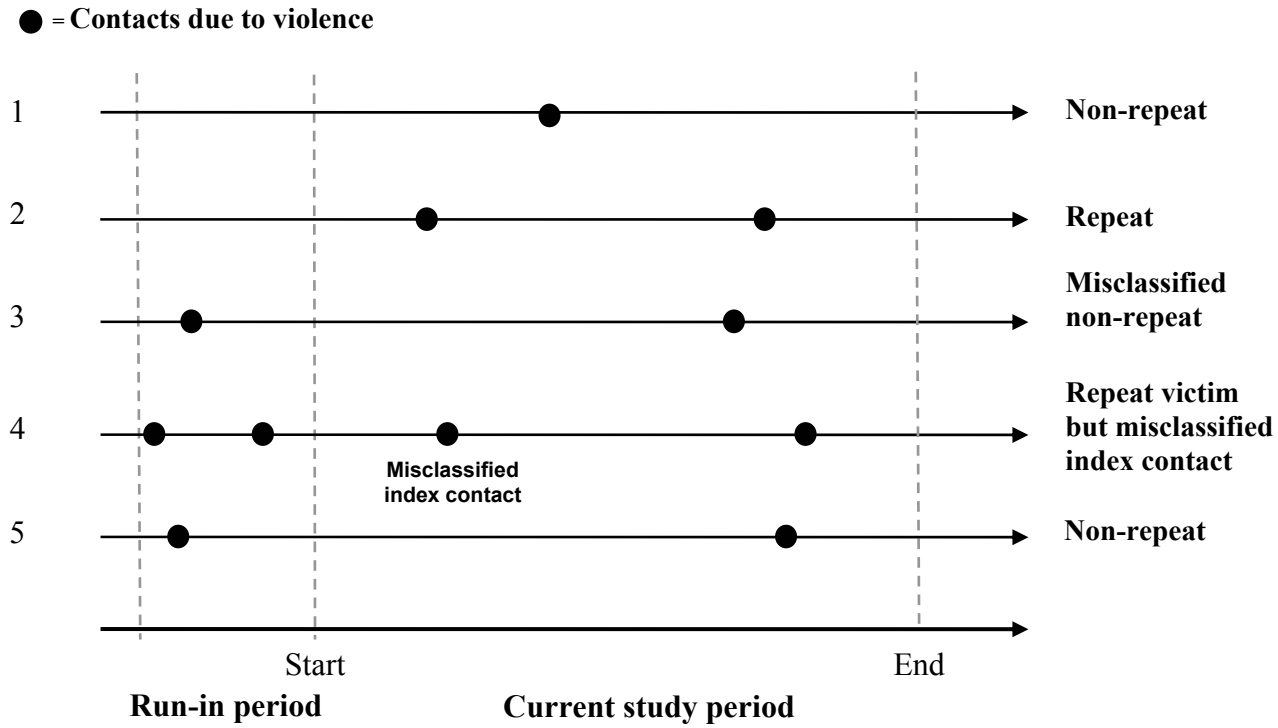
So far no reliable and valid tool for measuring severity and changes in the severity of injuries from violence is available. The Abbreviated Injury Scale (AIS) has been used in several studies.[28,43,45,46,51,68,153] The AIS which was developed by the American Association for the Advancement of Automotive Medicine is designed for the rating of road traffic injuries and reflects the probability of death from the injuries.[154] Unfortunately, AIS cannot distinguish the large group of patients with minor injuries due to violence and also has a low sensitivity for measuring changes over time. In most studies of violence more than 80 % of the injuries are rated as minor (AIS=1).[28,43,45,46,51,66,68,153] A violence specific scale has been developed by Shepherd.[155] The scale is based only on the type and number of injuries, not on the severity of the injuries. The scale seems to be more sensitive than the AIS.[156] Unfortunately, so far the scale has not been sufficiently validated or extensively used.

Therefore, in this study we decided to use time trends in the type of lesions, the injured body regions, the use of weapon, and the mortality rate as indicators of changes in severity in the study period.

7.2. Defining a run-in period (Studies 2 and 3)

For reliable identification of repeat victims, non-repeat victims, and index contacts a five year run-in period was taken into account. The objective was to minimize the misclassification of non-repeat victims and of index contacts among repeat victims (see Figure 7.1). More specifically, we wanted to minimize the number of individuals defined as non-repeat victims in the analyses who had had contacts with the A&E department due to violence prior to the study period. Additionally, we wanted to reduce the number of index contacts among repeat victims in the study whose contact with the A&E department and/or the IFM was not the overall first contact due to violence.

Figure 7.1. The principles for applying a five year run-in period in order to minimize the misclassification of non-repeat victims and index contacts among repeat victims.



Prior to the study we estimated the proportion of victims in different years and in the entire study period 1991-2002 who had also had contact with the A&E department because of violence in the preceding years in order to determine the optimal length of the run-in period. The five year run-in period was chosen in order to minimize the risk of misclassifications without reducing the sample size unnecessarily.

Table 7.1 shows the number of individuals with contacts with the A&E department and/or the IFM due to violent victimization in 1991, 1996 and 2002, and the proportion of these who had also had contact in the preceding years. The table is constructed in such a way that the number in a given year (year -x) are those who would be misclassified if the run-in period was less than the given year. For example, 19 individuals among those with contact(s) in 1991 had the most recent prior contact in 1985 (year -6). The distribution of previous contacts was identical in the entire study period 1991-2002. Appendices D and E summarize the proportion of individuals with contacts due to violence in the preceding years for non-repeat victims as well as repeat victims.

Table 7.1. The number of individuals with contacts with the A&E department and/or the IFM due to violent victimization in 1991, 1996 and 2002, and the proportion of these who had also had contact in the preceding years.

	Study year		
	1991	**1996**	**2002**
Number of individuals	1134	982	1102
Repeat contacts same year	91 (8.0 %)	57 (5.8 %)	77 (7.0 %)
Contacts in:			
Year -1	133 (11.7 %)	86 (8.8 %)	100 (9.1 %)
Year -2	58 (5.1 %)	53 (5.4 %)	77 (7.0 %)
Year -3	50 (4.4 %)	34 (3.5 %)	42 (3.8 %)
Year -4	42 (3.7 %)	27 (2.7 %)	26 (2.4 %)
Year -5	34 (3.0 %)	26 (2.6 %)	35 (3.2 %)
Year -6	19 (1.7 %)	24 (2.4 %)	18 (1.6 %)
Year -7	21 (1.9 %)	17 (1.7 %)	14 (1.3 %)
Year -8	12 (1.1 %)	13 (1.3 %)	13 (1.2 %)
Year -9	10 (0.9 %)	15 (1.5 %)	16 (1.5 %)
Year -10	9 (0.8 %)	15 (1.5 %)	8 (0.7 %)

7.3. Register merging (Study 4)

7.3.1. Demographic and socioeconomic data sources

Before the merging of data we had to decide which registers we wanted to employ. Combined, the Danish Register for Health and Social Conditions (DRHSC) and the Integrated Database for Labour

Market Research (IDA) contain a broad range of variables which seemed feasible for describing demographic and socioeconomic risk factors.[157,158] Both DRHSC and IDA are maintained by Statistics Denmark.

IDA contains longitudinal information on labour market affiliation as well as some demographic and socioeconomic data about the entire Danish population for the period 1980 and onward.[157] The database is constructed specifically for research purposes and the content is extracted from several other databases at Statistics Denmark. IDA contains variables about ethnicity, family, education, occupation, and income (see Appendix F).

Since DRHSC was established in 1977 it has been extended several times.[158] In addition to longitudinal health data covering all contact to the somatic health care system in Denmark the register also contains some socioeconomic information. The register covers information about the entire Danish population. The health data are based on data from the Danish National Patient Registry maintained by the Danish National Board of Health. The socioeconomic data contain variables describing housing and social benefits (sick leave, maternity leave, cash benefit, pension, disablement pension, unemployment benefit etc.)(see Appendix F).

The majority of information in the two databases is based on an annual status regarding demography and socioeconomics on a specific date, for example 31 December or 1 October. Other variables are updated continuously or are cumulative covering a year.

From both registers we decided to extract a large number of variables which we believed were applicable.

7.3.2. Dealing with children and adolescents

In order to analyse risk factors for victims of all ages we decided also to extract demographic and socioeconomic information regarding the parents of those cases and controls who were children or adolescents. At Statistics Denmark it is possible to link individuals to their parents using specific variables.

In some situations the parents' demographic and socioeconomic status is more important for the child or adolescent than that of the child or adolescent victim. At Statistics Denmark information about four types of parents is recorded – the biological mother and father, and the social mother and father. In most situations the biological and social parents are the same. In other situations one or

both of them may not be the same. Therefore, we had to decide, which parents are the most demographically and socioeconomically important for each child and adolescent if the biological and social parents are not the same. Additionally, the social parents may change (several times) during childhood and adolescence.

Another obstacle in planning the study was to define the terms child, adolescent, and adult. According to the Danish authorities an individual come of age and is considered an adult at the age of 18 years. On the other hand, in Denmark the majority of individuals aged 18 years are still living with their parents and their socioeconomic status may still be dependent on their parents (biological and/or social parents). Additionally, young individuals who are living away from their parents may to some extent still be socioeconomic dependent on their parents. Statistics Denmark distinguish between the terms child (0-17 years), adolescent (18-19 years), and adult (20 years or more).

In order to achieve secure models and analyses of demographic and socioeconomic risk factors for children and adolescents we had to combine information regarding biological and/or social parents with appropriate definitions of children and adolescents. Secondly, we had to decide which parents were the most important in order to extract the most relevant variables. Therefore, we decided to separate the victims into three age groups according to the definitions of Statistics Denmark (children, adolescents, and adults). For this work we decided only to analyse risk factors for violent victimization among adults aged 20 years or more.

7.3.3. Partners

In order to describe risk factors regarding a partner a key variable "cfelle", which contained the cpr-number of the partner, was used to link cases and controls to their partner. A linkage to a partner was made for the following types of relationships:

1. Married couples
2. Registered partnerships
3. Couples living in consensual union
4. Cohabiting couples

Additionally, cohabiting couples had to fulfil the criteria of being unrelated, having different sexes, and being aged 17 years or more. Additionally, the persons in a couple had to live on the same home address and no other adult was allowed to live in the same household. The definition used

may misclassify some persons living together as couples and vice versa. However, no better and more reliable variables were available or could be constructed.

8. METHODS AND MATERIALS

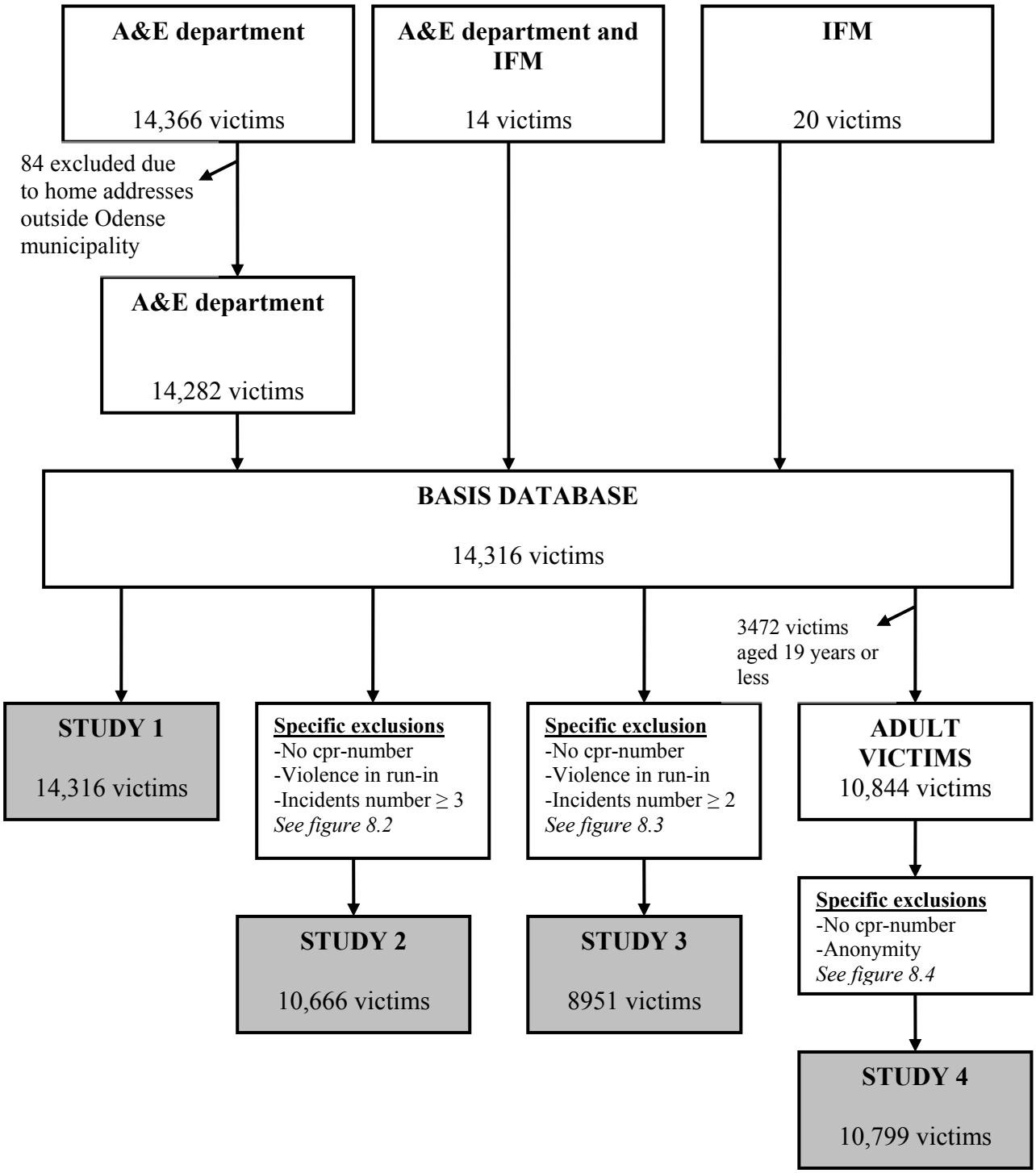
Five separate studies were conducted. Table 8.1 summarizes the five studies with regard to design, objective, study year, and resulting papers.

Table 8.1. The five studies conducted: design, objective, study year, and papers.

Study	Design	Objectives	Year	Paper
1	Cohort study	Age and gender specific incidence rates of violent victimization. Trends in incidence rates. Trends in severity.	1991-2002	I
2	Cohort study	Estimation of twelve year recurrence proportion of repeat contacts with an A&E department and/or IFM. Survival analysis of time span from first to second contact. Similarities between recurrent incidents leading to first and second contacts.	1991-2002	II
3	Cohort study	Estimation of lifetime risk.	1991-2002	III
4	Case-control study	Assessment of the feasibility of describing demographic and socioeconomic risk factors of violent victimization by data merging. Demographic and socioeconomic risk factors of adult violent victimization.	1991-2002	-
5	Cohort study	Completeness of A&E department data. Estimation of the proportion of victims attending the A&E department recorded by the police.	2003-2004	-

The material included in study 1 served as the "baseline material" for studies 2-4. Figure 8.1 shows the relation between the included victims in studies 1-4. Study 5 was conducted independently of studies 1-4.

Figure 8.1. The relation between the included victims 1991-2002 in studies 1-4.



8.1. Study 1 – Frequency and trends (Paper I)

8.1.1. Design

The study is a descriptive cohort study. The cohort is the entire population of Odense Municipality in the period from 1991 to 2002.

Included in the study were all victims of deliberate interpersonal violence attending the A&E department at OUH or subjected to medicolegal autopsy at the IFM at SDU in the period from 1991 to 2002. Included were only those victims who were also residents of Odense Municipality at the time of the incident. In case of more than one contact for the same incident only the first contact was included. From the routinely kept patient registration system at OUH the cases for this study were included prospectively and consecutively as they presented themselves for treatment.

The cases from the IFM were identified by the author by a complete review of all autopsy reports for the period 1991 to 2002. For cases in compliance with the study case definition, the NOMESCO classification and ICD coding with a maximum of 5 diagnoses were recorded for each patient.[7-9]

8.1.2. Materials

Overall, 14,400 victims met the inclusion criteria. Of those, 14,366 victims were solely included at the A&E department, 20 victims solely at the IFM, and 14 victims were included at both locations (see Figure 8.1 and Table 8.2). A check-up on the victims' home addresses in the Danish Civil Registration System revealed that 84 (0.6 %) victims, solely included at the A&E department, were not residents of Odense Municipality at the time of violence. Those were victims who had moved to Odense Municipality which had not been recorded in the hospital register.

This leaves 14,316 victims for the study. For all victims information on age, gender, date of violence, time of violence, location of violence, weapon use, diagnoses, and days of hospitalization was obtained from the patient registration system, the medical records and/or from the autopsy reports.

Table 8.2. The number of included victims treated at OUH, or subjected to a medicolegal autopsy at IFM, or both, 1991-2002.

Year	OUH	Both OUH and IFM	IFM	All
1991	1237	2	3	1242
1992	1246	2	1	1249
1993	1154	1	1	1156
1994	1375	1	3	1379
1995	1118	1	3	1122
1996	1045	1	0	1046
1997	1183	0	2	1185
1998	1137	3	1	1141
1999	1193	1	2	1196
2000	1203	1	4	1208
2001	1200	0	0	1200
2002	1191	1	0	1192
Sum	14,282	14	20	14,316

8.1.3. Rating trends in frequency and severity

The victims were grouped into five different age groups: 0-14, 15-24, 25-39, 40-59, and 60 years or more. Based on mid-year population counts age and gender specific annual incidence rates were estimated with 95 % confidence intervals (CI). Additionally, Poisson regression was used in analyses of changes in annual incidence rates in the study period (Stata command: poisson).

Time trends in lesion types, injured body regions, weapon use, and mortality rate were used as indicators of changes in severity of violence in the study period. Only information on diagnoses from 1994 an onward were analysed because of the inconsistencies between ICD8 and ICD10 and the inconsistencies between the maximum number of diagnoses recorded for each patient in the study period. The diagnoses were used for constructing two variables describing the lesion type and body region injured. Lesion types were grouped into six ordered categories: less serious lesions

(abrasion or contusion), wounds, sprains/dislocations, bone fractures, deep lesions (lesions to nerves, tendons, blood vessels, or internal organs), and other (burns, poisoning, foreign bodies, or unspecified lesions). Body regions were grouped into five regions: head or neck, thorax or abdomen, upper limbs, lower limbs, and other (poisoning, spine lesions, or unspecified lesions). A non-parametric trend test was used in the analyses of changes in type of lesion, body region injured, and weapon use in the study period (Stata command: nptrend).

Based on mid-year population counts the overall mortality rate was estimated with a 95 % CI and Poisson regression was used to analyze changes in the annual mortality rate in the study period (Stata command: poisson).

8.2. Study 2 – Repeat contacts due to violent victimization (Paper II)

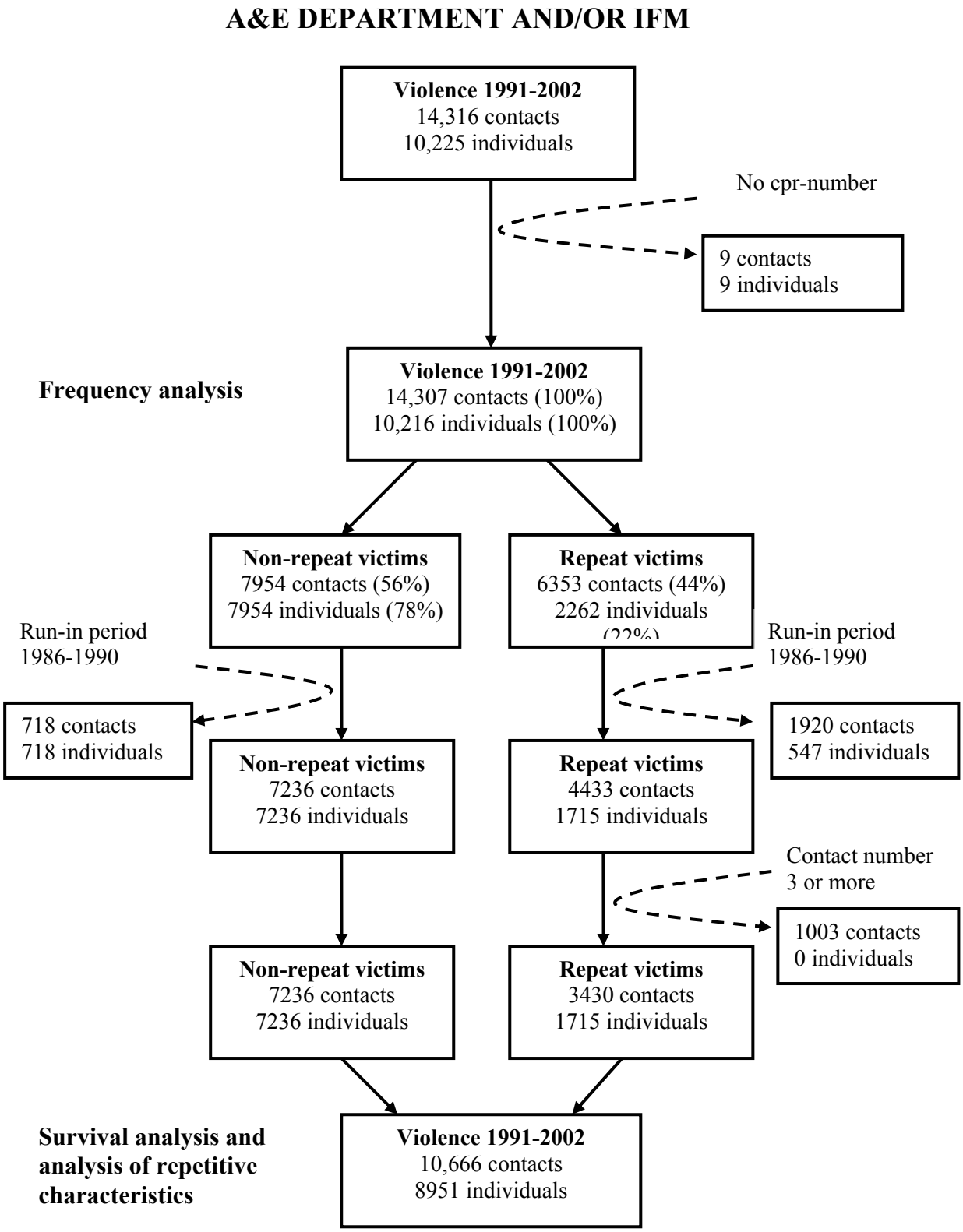
8.2.1. Design

The study is a descriptive cohort study. For inclusion criteria see section 8.1.1. Individual, repeat victim, non-repeat victim, and index contact were defined previously (see section 4.9). The cpr-number was used for identifying individuals with recurrent contacts with the A&E department and/or the IFM. The five year run-in period was used for identifying "true" repeat victims, "true" non-repeat victims, and "true" index contacts (see section 7.2).

8.2.2. Materials

In the study period 14,316 contacts due to violence involving 10,225 different individuals met the inclusion criteria (see Figure 8.1). Figure 8.2 summarizes the inclusions, exclusions, and the number of repeat and non-repeat victims in the study. Nine individuals and their nine incidents were excluded as they did not have a cpr-number at the time of contact with the A&E department and/or the IFM. These victims were immigrants who had not yet been assigned a cpr-number. This leaves 10,216 individuals and 14,307 contacts for frequency analysis of repeat contacts. Subsequently, 1265 individuals and their 2638 contacts were excluded due to violence in the run-in period. Finally, all contacts number 3 or more were excluded leaving 8951 individuals with 10,666 contacts for survival analysis and analysis of repetitive characteristics between index and second contact due to violence.

Figure 8.2. Inclusions, exclusions, and the number of repeat and non-repeat victims.



8.2.3. Frequency analysis of repeat contacts

Overall and gender specific recurrent proportions were estimated as the proportion of individuals with more than one contact with the A&E department and/or the IFM due to violence in the study period.

8.2.4. Survival analysis and analyses of repetitive characteristics

The victims' civil addresses from 1991 to 2002 were extracted from the Danish Central Office of Civil Registration. The age of the victims was defined as age at the time of the index contact. The victims were then grouped into age categories. Kaplan-Meier survival analyses were made with time of observation from index contact to the first date of one of the following incidents: second contact due to violence, moving away from Odense Municipality, death, or expiry of study period on 31 December 2002. Failure was defined as second contact due to violence. Table 8.3 summarizes the declaration of data for survival analyses (Stata command: stset).

Table 8.3. Declaration of data for survival analysis with Stata 8.1™(command: stset).

Option	Definition
Date of origin	First contact due to violence
Date of entry	First contact due to violence
Failure	Second contact due to violence
Date of exit	31 December 2002
Scale	365.25 (years)
Censored	Death or moving away from Odense Municipality

The variables place of violence, weekday of violence, time of violence, weapon use, type of lesion, and referral were analysed for repetitive characteristics. A repetition percentage was estimated as the proportion with repeated characteristics of the incident leading to the second contact compared to the incident leading to the index contact. Fisher's exact test was used to determine statistical similarity between index and the second contact. For analysis of repetitive characteristics the lesion types were ordered according to growing severity: less serious lesion (abrasion or contusion),

wound, sprain/dislocation, bone fracture, and internal lesion (injury to internal organ, nerve, blood vessel or tendon). The most severe lesion leading to the index contact was compared to the most severe lesion leading to the second contact.

8.3. Study 3 – Estimation of lifetime risk (Paper III)

8.3.1. Design

For inclusion criteria see section 8.1.1. Individual, repeat victim, non-repeat victim and index contact were defined previously (see section 4.9). The cpr-number was used for identifying individuals with recurrent contacts with the A&E department and/or the IFM. The defined five year run-in period was then used for identifying "true" first time contacts with the A&E department and/or the IFM due to violence (see section 7.2).

8.3.2. Materials

Figure 8.3 summarizes the inclusion and exclusion of individuals and incidents for the study. Nine individuals and their nine contacts were excluded as they did not have a cpr-number at the time of violence. These victims were immigrants who had not yet been assigned a cpr-number. All 1265 individuals (with a total of 2638 contacts) who were victims of violence in the study period 1991-2002 as well as in the run-in period 1986-1990 were excluded from the study.

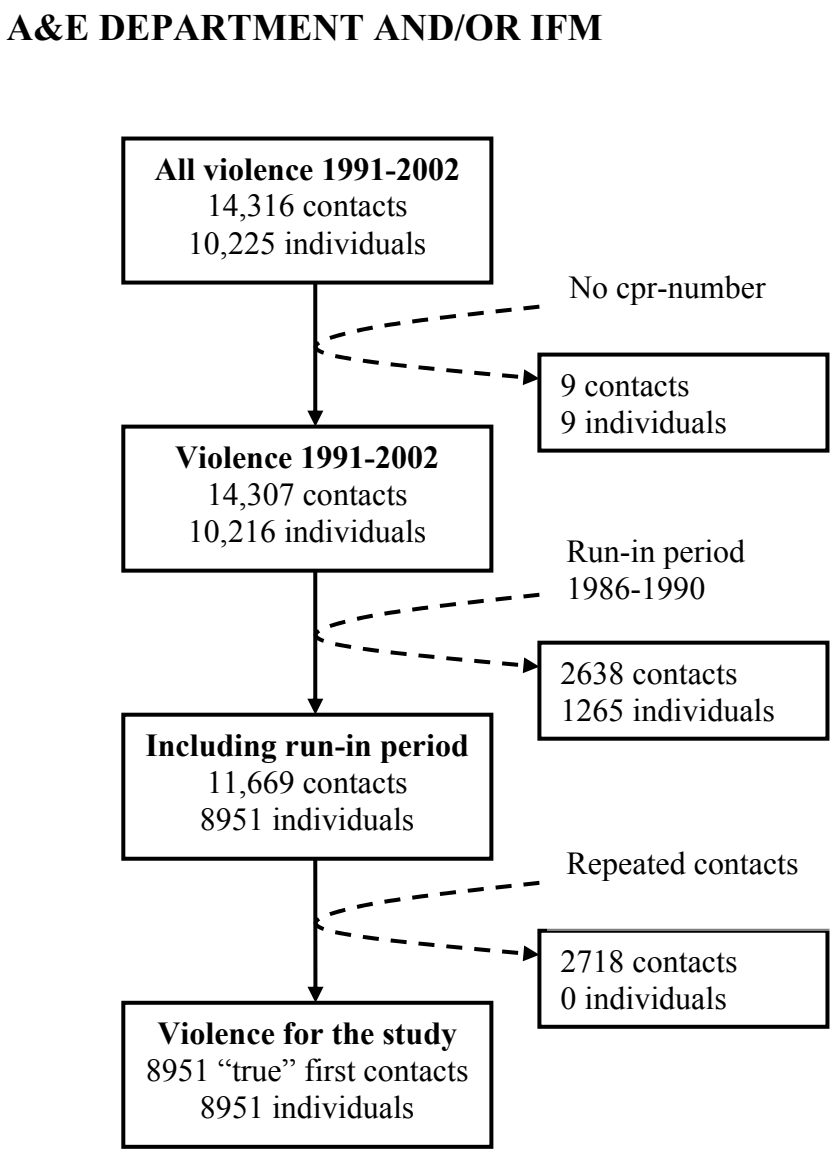
Additionally, 2718 repeat contacts (two or more contacts) were excluded leaving 8951 "true" first time contacts for the study.

8.3.3. Estimation of incidence rates of first time contacts

The population at risk was estimated by using age and gender specific mid-year population counts. Those who had been victims of violence in the run-in period were deducted from the population at

risk. Based on the adjusted population at risk, age and gender specific annual incidence rates of first time contact with the A&E department and or the IFM due to violence were estimated. Poisson regression was used to analyse whether any trend in the age and gender specific annual incidence rates of first time contacts was present in the study period (Stata command: poisson).

Figure 8.3. The inclusion and exclusion of individuals and incidents for estimation of the lifetime risk.



8.3.4. Estimation of lifetime risk of violent victimization

We estimated the lifetime risk of contact with the A&E department and/or the IFM through exposure to violence. The estimate was based on the estimated age and gender specific annual incidence rates of contact and the survival rates of the background population using Keiding's formula:[159]

$$\mathrm{CIP}_a = \sum(ASIR_a)$$
$$CMP_a = \sum(ASMR_a)$$
$$S_a = exp(-\mathrm{CIP}_a)exp(-CMP_a)$$
$$R_a = \sum(ASIR_a \ x \ S_a)$$
$$LR = R_{99}$$

$ASIR_a$ = *Age specific incidence rate of violence for the period 1991 to 2002*
$ASMR_a$ = *Age specific mortality rate for the period 1991 to 2002*
CIP_a = *Cumulative incidence proportion (at age a)*
CMP_a = *Cumulative mortality proportion (at age a)*
S_a = *Age specific probability of being alive and non-victimized (at age a)*
R_a = *Risk of having been victimized before age a*
LR = *Lifetime risk of violence (at age 99 years)*

The estimation assumed calendar time stationarity of incidence rates. Basically, the formula sums up the products of the age-specific probability of being at risk (alive and no previous victimization) with the age specific rate of becoming victimized leading to contact with the A&E department and/or the IFM. The lifetime risk was defined as the cumulative age specific risk from birth to age 99 years in the population. Additionally, the cumulative gender specific risk within different age groups was estimated by summing up the age specific risks within the age group of interest.

8.4. Study 4 – Demographic and socioeconomic risk factors

8.4.1. Design

The study is a register-based case-control study using population-based controls. The cases for the study were all victims of deliberate interpersonal violence aged 20 years or more and attending the A&E department at OUH or subjected to medicolegal autopsy at the IFM at SDU in the period 1991

to 2002. For every victim five frequency matched controls, which were matched on age, sex, and date of violence, were randomly selected from the total population of Odense Municipality. The controls were extracted from the Danish Civil Registration System by the Danish Central Office of Civil Registration. We allowed each individual to be selected more than once as control for different cases and cases to be selected as controls for other cases. Demographic and socioeconomic information about cases and controls was extracted from IDA and DRHSC.

8.4.2. Material and extraction of variables (Steps 1 and 2)

Figure 8.4 shows inclusion and exclusion of cases, selection of controls, and extraction of demographic and socioeconomic variables from IDA and DRHSC. Of the 14,316 victims of violence who had been in contact with the A&E department and/or the IFM, 10,844 were aged 20 years or more (see Figure 8.1). Three victims were excluded as they did not have a cpr-number at the time of violence, being immigrants. Another 42 victims were excluded because they had requested that the Danish Civil Registration System disclose no information for research purposes. The remaining 10,799 cases constituted the study population.

From the Danish Civil Registration System, 53,986 controls matched on age, gender, and date were randomly selected from the background population of Odense Municipality. In five cases (0.1 %) it was not possible to select five matched controls. The cases in question were 93 years or more with a very small number of matching controls in the background population. The Danish cpr-number was used as a key for retrieving and merging individual demographic and socioeconomic data on cases and controls from IDA and DRHSC.[157,158] Additionally, for cases and controls living in a relationship, demographic and socioeconomic data concerning their partner was also extracted from the registers.

For all variables the latest status information before violent victimization or before selection as a control was extracted from the registers

A step-by-step model for analyses of demographic and socioeconomic risk factors of violent victimization was made (see Figure 8.5). The first step was the extraction of a large number of variables. The second step was the exclusion of extracted variables which contained high numbers of missing values (>10 %) or information regarding only a limited part of the study period, or which were inconsistently coded for the study period.

Figure 8.4. Inclusion and exclusion of cases, selection of controls, and extraction of demographic and socioeconomic variables for study 4.

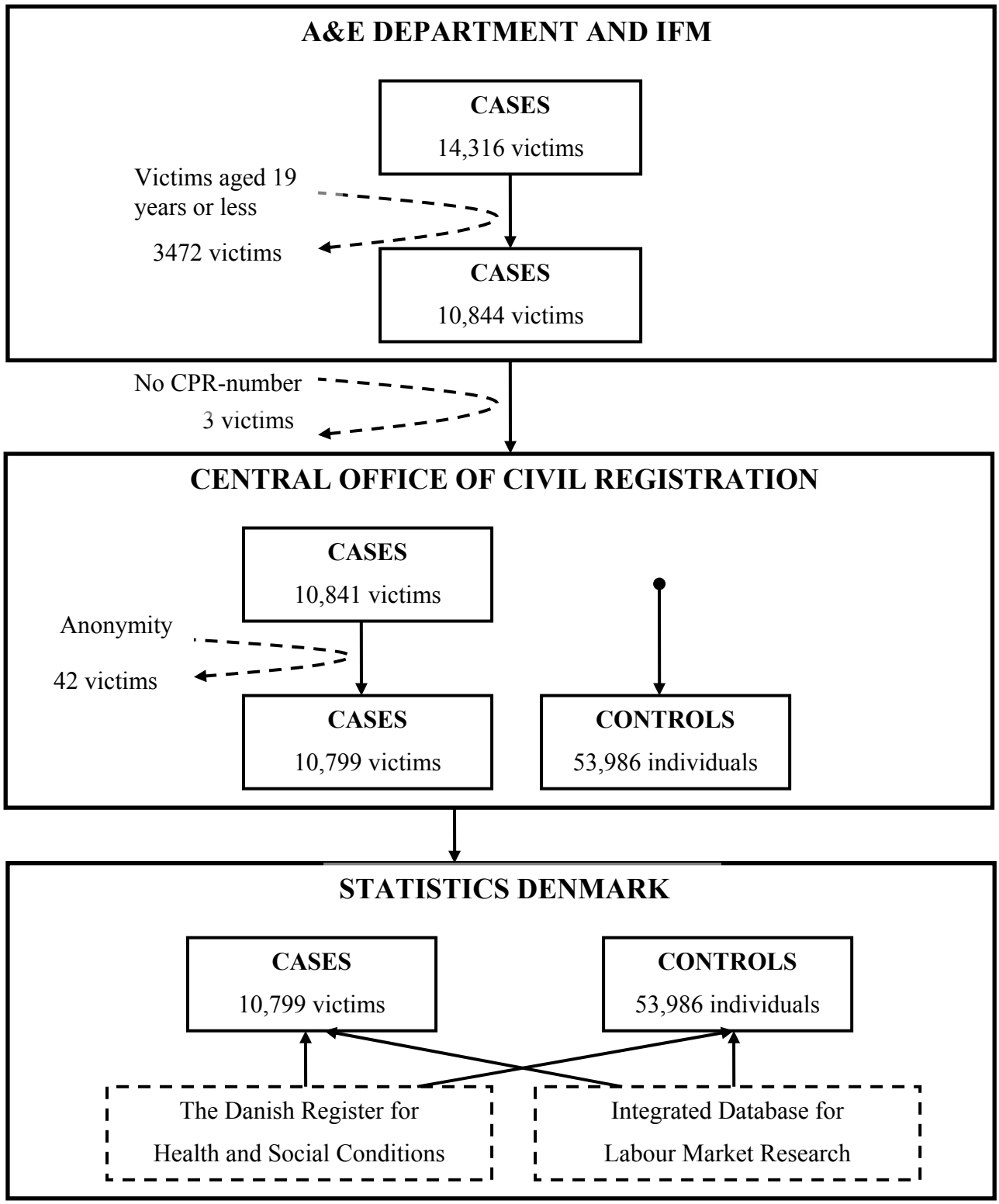
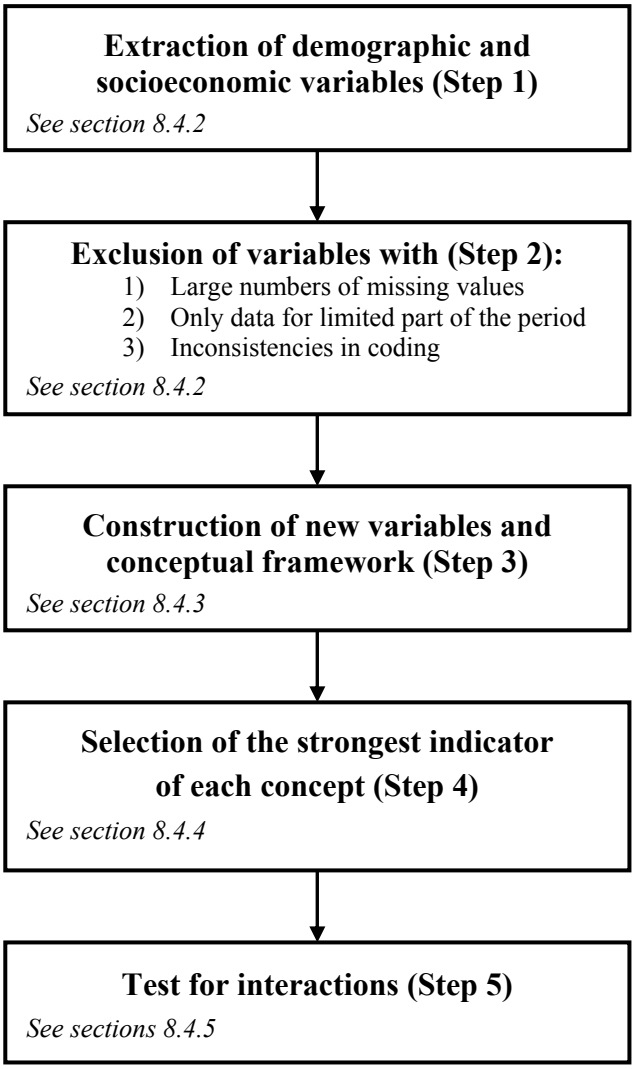


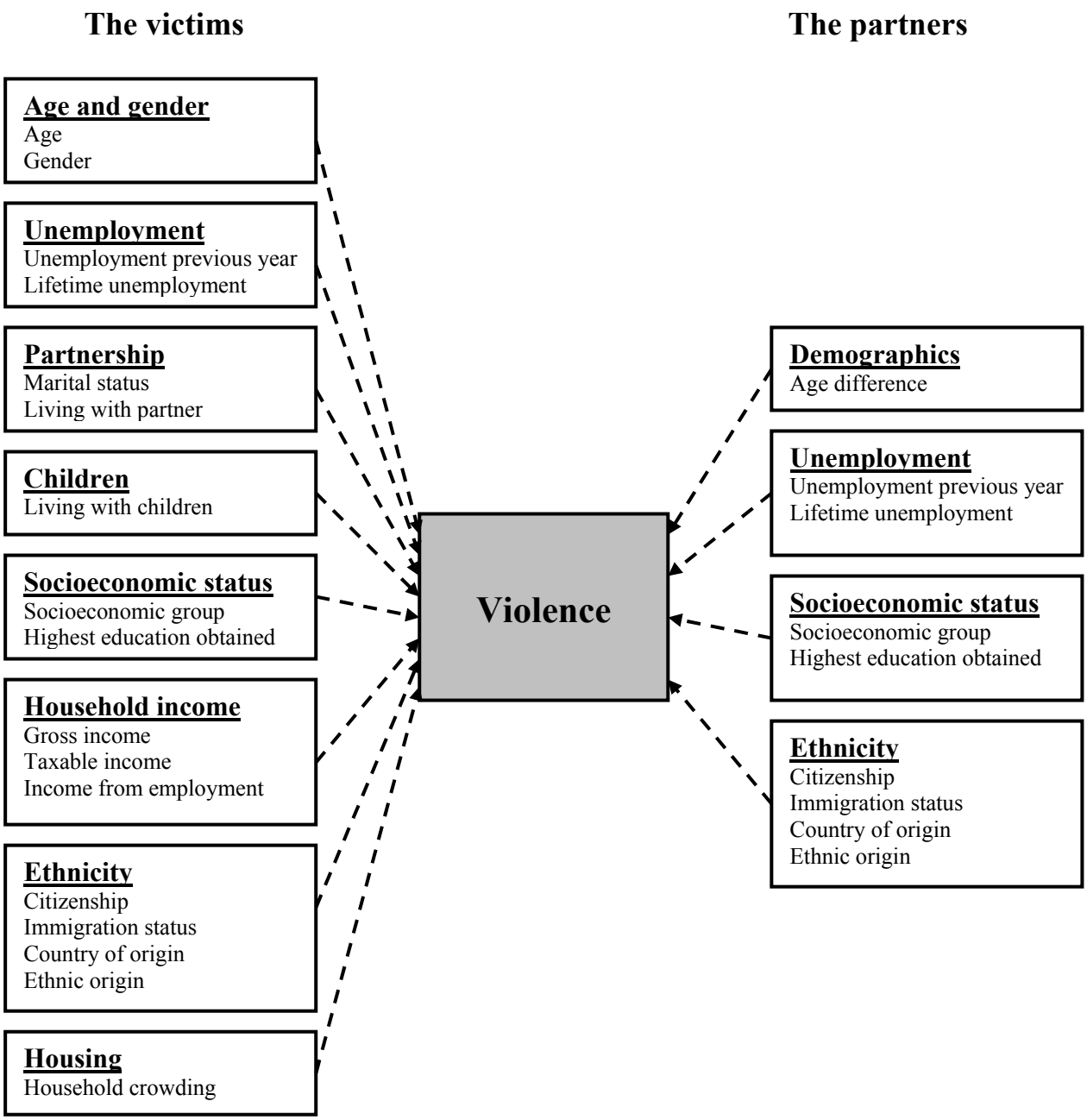
Figure 8.5. The stepwise building of a model for analyses of demographic and socioeconomic risk factors of violent victimization.



8.4.3. Construction of new variables and conceptual framework (Step 3)

The third step was the construction of several new variables describing demographic and socioeconomic conditions and the defining of a conceptual framework.

Figure 8.6. The conceptual framework for analyses of demographic and socioeconomic risk factors.



Appendix F summarizes the variables extracted from IDA and DRHSC concerning cases, controls and their partner, including the relation between the extracted and constructed variables. The extracted and constructed variables were grouped according to eight different concepts of risk factors related to the victim (age and gender, unemployment, partnership, children, socioeconomic status, household income, ethnicity, and housing) and four different concepts of risk factors related

to the partner (demographics, unemployment, socioeconomic status, and ethnicity). The variables of each group were all indicative of the same pre-specified concept. Figure 8.6 shows the variables allocated to the different concepts.

Two variables were chosen to describe unemployment: “unemployment the previous calendar year” referring to the number of days the subject was unemployed the previous calendar year per 1000 working days and “lifetime unemployment” referring to the summarized number of days the subject had been unemployed since the age of 16 years and until the age of 66 years. The number of unemployment days was divided by the number of living years since age 16 and until age 66. The variable was divided into two categories of equal size.

Two variables were included to describe the partnership: “marital status” and “living with partner”. The extracted variable “marital status” describing the legal marital status (married, divorced etc.) was simplified by reducing the number of categories. A new variable “living with partner” was constructed to describe whether the subject was living with a partner or not. The new variable was constructed from the variable “cfelle” which links to a partner (cpr-number)(see section 7.3.3).

Using the variable “household type” a new variable “living with children” was constructed which describes whether the cases or controls were living with children or not. The variable solely described the concept of children.

Two explanatory variables were included to indicate socioeconomic status: “highest education obtained” and “socioeconomic group”. We defined “socioeconomic group” in the form of five levels describing the main employment status. Pensioner refers to all kinds of retirement from the labour market including old age pensioners, disability pensioners etc.

Three variables described household income: “household gross income”, “household taxable income”, and “household income from employment”. “Household gross income” was estimated as the summarized annual income of the adults in the household/family divided by the number of adults in the household/family. The estimated income was converted into Euro (rate: 7.5 DKR per Euro). “Household taxable income” and “household income from employment” were estimated similarly,

Four variables describing ethnicity were included for modelling: “citizenship”, “immigration status”, “country of origin”, and “ethnic origin”. The extracted variable “citizenship” describes current citizenship and the variable “country of origin” describes country of birth. The variable “immigration status” describes immigration status, where 1st generation immigrant refers to

immigrants born in another country and 2nd generation immigrant refers to persons who were born in Denmark but who are descendants of immigrants born in another country. The variable “ethnic origin” was constructed by combining the extracted variables “land of origin” and “immigration status”.

By combining the variables “household type” and “size of housing”, a new variable, "household crowding”, was constructed as the number of square meters per resident in the household. The variable solely described the concept of housing

For cases and controls living in a relationship, a new variable, “age difference”, describing the difference in age between case or control and their partner, were constructed. Additionally, the concepts unemployment, socioeconomic status, and ethnicity describing the partners were included.

8.4.4. Selection of one variable for each concept (Step 4)

In the fourth step the strongest indicator of each concept was selected and temporary models were built. Appendix G shows the selection of the strongest indicator within each concept.

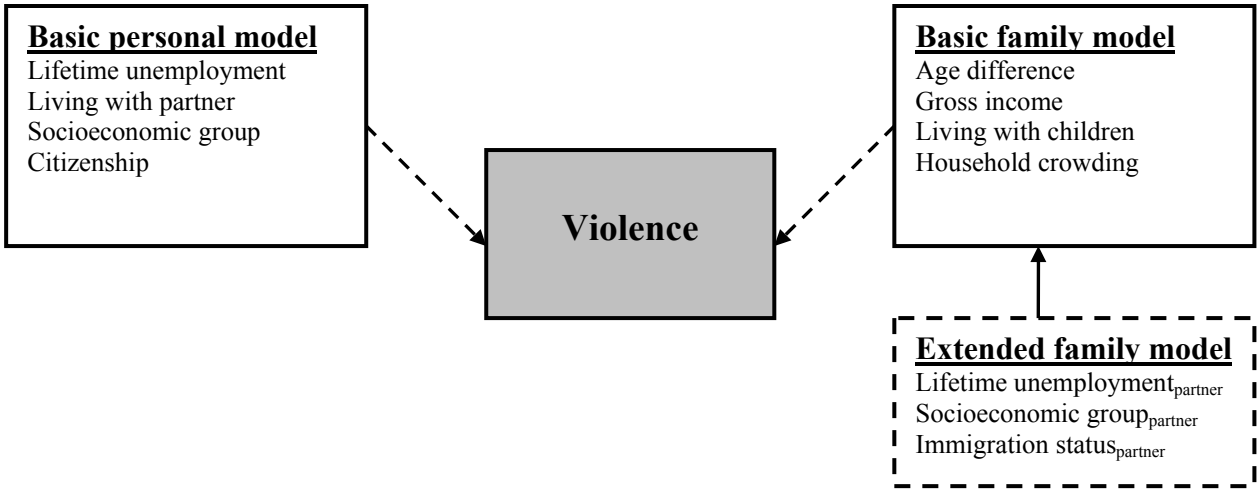
By design age, gender, and year of violence were included in the modelling. Based on previous literature the concept of “unemployment” was believed to be the most important contributor to the risk of violence and was included in the model next (I). Logistic regression was performed by including the two variables “unemployment previous year” and “lifetime unemployment” one at a time. As the variable “lifetime unemployment” had the highest change in likelihood ratio (ΔLHR=1579.60) and therefore the strongest relation to violent victimization, it was included for further modelling. Then the variables describing the second most important concept (partnership) were included and the variable “living with partner”, which led to the highest change in likelihood ratio (ΔLHR=2335.58), was included for further modelling (II). The rest of the concepts were handled similarly. All concepts regarding the victims were included prior to the concepts regarding the partners as they were considered of higher importance.

8.4.5. Interaction tests and the final model (Step 5)

The selected variables were then allocated into two basic models (see Figure 8.7). The first model (the basic personal model) included basic variables related to the victim (lifetime unemployment,

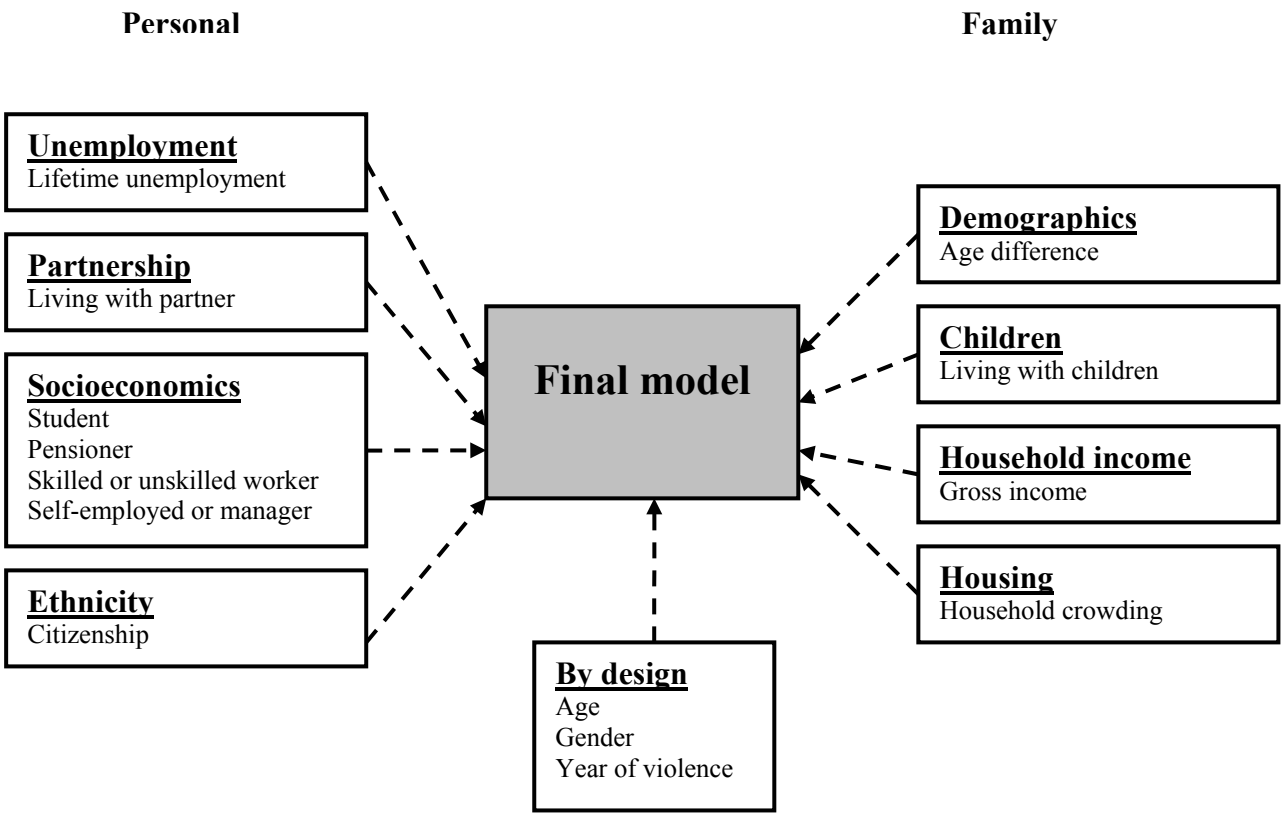
living with partner, socioeconomic group, and citizenship). The second model (the basic family model) included basic variables related to the family (age difference, household gross income, living with children, and household crowding). Additionally, an extended family model was constructed including the variables from the basic family model plus a further three variables (lifetime unemployment of partner, socioeconomic group of partner, and immigration status of partner).

Figure 8.7. The allocation of the remaining variables into two basic models containing personal and family variables, and an extended family model.



The variables of each of the two basic models and the extended model were tested for interaction, and the number of categories excluded due to collinearity was evaluated. Appendix H shows the changes in likelihood ratios and changes in degree of freedom when interactions of the three models are included. Both the basic personal model and the basic family model seemed robust. However, the variable "socioeconomic group" has several interactions with the other variables. Especially, the categories "unemployed/sick leave" and "pensioner" interacted with the variable lifetime unemployment. To reduce this interaction the variable "socioeconomic group" was divided into four bivariate variables: "student", "pensioner", "skilled or unskilled worker", and "self-employed or manager". A high number of interactions and exclusions due to collinearities made the extended family model seem less robust. Therefore, a final model was constructed combining the basic personal and basic family models (see Figure 8.8).

Figure 8.8. The final model for analyses of demographic and socioeconomic risk factors of violent victimization.



8.4.6. Statistical analyses

The final model was analysed using unconditional logistic regression estimating odds ratios (ORs) with a 95 % CI (Stata command: logistic). The ORs were estimated in a crude/unadjusted model, a semiadjusted model which was only adjusted for age, gender and year of violence, and a fully adjusted model which was adjusted for age, gender, date of violence, and all other variables included in the final model. All variables were analysed as non-ordered categorical variables.

8.5. Study 5 – Comparison of A&E department and police recorded data

8.5.1. Design

The study is a descriptive cohort study. The cohort was the entire population of Odense Municipality in the period from 1 March 2003 to 29 February 2004.

Included in the study were all victims of violence from Odense Municipality attending the A&E department at OUH and/or recorded by Odense Police Department due to violent incidents occurring in the period from 1 March 2003 to 29 February 2004. Because of the time delay from the violent incident and until medical treatment and reporting all victims of violence attending the A&E department 1 March 2004, and all victims reporting to the police until 31 October 2004 were also registered. Only victims in the study period were included.

At the A&E department all victims were registered according to the basic registration (see section 4.1). Additionally, the event specific NOMESCO codes for events of violence were used (See Appendix B).[7]

For the victims recorded by the police cpr-number, date of violence, time of violence, location of violence, and weapon use were registered. Additionally, the information according to the NOMESCO codes for events of violence was obtained (see Appendix C).[7]

8.5.2. Materials and analyses

The data from the A&E department and the police were separately entered twice in Epidata 3.1© by the author.[162] The contents of the two files were compared using the Epidata option and discrepancies were corrected. In each case the cpr-number entered was validated using the modulus 11 test for Stata 8.1™ developed by Juul (Stata command: cprcheck).[163]

By using the cpr-number as linkage, date of violence and location of violence data from the A&E department and from the police were merged manually. We estimated the completeness of the registration made by the A&E department and by the police by estimating the proportion of all registered violence (by both the A&E department and the police) that was registered at the A&E department and by the police stratified by age, gender, location of violence, counterpart, weekday of violence, time of violence, and use of weapon. Additionally, the proportion of victims attending the

A&E department who also reported to the police was estimated stratified by age, gender, location of violence, counterpart, weekday of violence, time of violence, and use of weapon.

8.6. Ethics

All parts of the thesis are based on register data. According to the Danish National Committee on Biomedical Research Ethics studies on register-based data including data from medical records or autopsy reports do not need approval by any ethics committee.[164]

No information regarding the victims of violence attending the A&E department and/or subjected to medicolegal autopsy at the IFM was transferred to the police authorities. Furthermore, the police authorities did not have or will not gain access to data from the A&E department.

All parts of the study were approved by the Danish Data Protection Agency and all data concerning both victims and controls were kept in accordance with the Danish Act on Processing of Personal Data.[165]

The access to the demographic and socioeconomic data from IDA and DRHSC was approved by Statistics Denmark. The extraction of data was done by programmers at Statistics Denmark, and analyses were based on de-identified/anonymized micro data from SDU through the Internet. Before electronic access was given the author and the Accident Analysis Group were authorized by the Statistics Denmark as users.[166]

9. RESULTS

9.1. Results of study 1 (Summary of paper I)

In the study period 10,481 (73 %) males and 3835 (27 %) females attended the A&E department at OUH and/or were subjected to medicolegal autopsy at the IFM (male/female ratio = 2.7). The median age was 25 years (range 0-94 years) for males and 31 years (range 0-99 years) for females (Mann-Whitney, p=0.000). Victims of violence represented 3.6 % of all casualties attending the A&E department.

The gender specific annual incidence rate was 9.9 per 1000 population/year (95% CI: 9.7-10.1) for males and 3.4 (95% CI: 3.3-3.5) per 1000 population/year for females. For males the rate decreased and for females the rate was unchanged in the study period (Poisson regression, p=0.001 and p=0.588).

The 10,669 victims registered in 1994-2002 had 16,733 lesions corresponding to 1.6 lesions per victim. For both males and females the majority of the lesions were in the head or neck (63 % and 49 %) and the upper limbs (18 % and 24 %). The percentage of lesions in the head or neck decreased significantly in the group of males (nonparametric trend test, p=0.01) and increased significantly in the group of females (nonparametric trend test, p=0.03). For both males and females less serious lesions and wounds were the most common lesions (48 % and 64 % vs. 27 % and 13 %). In males 3 % and in females 2 % of the lesions were deep. For both males and females the percentage of less serious lesions increased in the study period (nonparametric test for trend, p=0.01 and p=0.01). The percentage of bone fractures and deep lesions decreased for both males (nonparametric trend test, p=0.01 and p=0.02) and females (nonparametric trend test, p=0.02 and p=0.03).

Three per cent of the victims were stabbed with a knife and 0.4 % had lesions from firearms. The percentages did not change in the study period 1991-2002 (nonparametric trend test, p=0.91 and p=0.94). Eight per cent were hospitalized with a median of 3 (range 1-184) days in hospital. The percentage showed no change in the study period (trend test, p=0.25).

Thirty-four (2.5 per 1000 patients) patients died as a result of their lesions, corresponding to a mortality rate of 1.6 per 100,000 population/year. There was no change in the mortality rate in the study period (Poisson regression, p=0.168).

9.2. Results of study 2 (Summary of paper II)

Overall 14,307 incidents involving 10,216 different individuals were included for frequency analysis. Overall 22 % of the individuals were repeat victims who were responsible for 44 % of all contacts to the A&E department and/or the IFM in the study period. For males and females 24 % and 18 % of the individuals, respectively, were repeat victims who were responsible for 46 % and 39 % of all contacts.

For individuals with repeat contacts the median number of contacts due to violence in the study period was two for both males (range 2-15) and females (range 2-12). Thirty-four individuals died from violence in the study period. Of those who died, 27 (14 males and 13 females) died following the incident leading to the first contact and seven died (four males and three females) following the incident leading to the second contact in the study period.

A total of 10,666 index and second incidents involving 8951 different individuals were included for survival analysis and analysis of repetitive characteristics. The median time span from index to the second contact was 1.75 years (range 0-11.44 years) for males and 1.64 years (range 1.00-9.91) for females (Mann-Whitney, p=0.385). Within four years 79 % of both males and females had had the next contact. For both males and females the median time span from index to the second contact decreased significantly with increasing age group. In the age groups 0-14, 15-29, 30-49, and 50+ years the median time span was 2.85, 1.69, 1.62, and 1.53 years respectively for males (Kruskal-Wallis, p<0.001), and 2.46, 2.03, 1.34, and 1.11 years respectively for females (Kruskal-Wallis, p=0.005).

A high repetition percentage was seen for violence occurring in the weekends and in the night-time. For men it was 72 % and 59 %, (Fisher's exact, p<0.001) and p<0.001), and for females it was 56 % and 50 %, respectively (Fisher's, p=0.101 and p=0.017). For both males and females a minor part of the index violence occurred with use of weapons. The repetition percentage for weapon use was 17 % for males (Fisher's exact, p=0.006) and 7 % for females (Fisher's exact, p=0.323).

Potentially severe lesions such as bone fractures and internal lesions occurred with a repetition percentage of 28 % and 19 % for males (Fisher's exact, p=0.006 and p=0.189), and 23 % and 25 % for females (Fisher's exact, p=0.041 and p=0.702). Of those hospitalised following the index violence 15 % of the males and 19 % of the females were also hospitalised following the next incident of violence (Fisher's exact, p=0.033 and p=0.121).

9.3. Results of study 3 (Summary of paper III)

A total of 8951 first time contacts of victims of violence attending the A&E department and/or subjected to medicolegal autopsy at the IFM were defined as cases for the study. Of these, 6381 (71 %) were males and 2570 (29 %) were females. The median age was 23 years (0-94 years) for males and 29 years (0-99 years) for females (Mann-Whitney, $p<0.001$).

The overall incidence rate of first time contact due to violence was 9.2 per 1000 population/year for males [95% CI: 9.0-9.4] and 2.6 per 1000 population/year for females [95% CI: 2.5-2.7]. For males the overall as well as the age specific incidence rate in the age group 40-59 decreased significantly in the study period (Poisson regression, $p=0.014$ and $p<0.001$). No change in the overall or the age specific incidence rates was observed for females.

For males the estimated annual risk reached a peak in adolescence with a maximum of 0.028 at the age of 18 years. From the age of 25 years and onward the risk decreased steadily. For females the estimated risk also reached a peak in adolescence with a maximum of 0.007 at the age of 16 years. Another peak in the estimated risk occurred among the elderly females.

For males the cumulative risk increased steeply in the adolescence. From the mid-twenties the cumulative risk increased more steadily, and for the elderly males the cumulative risk was almost constant. For females the cumulative risk increased steadily from adolescence till old age. The estimated lifetime risk (cumulative risk at age 99 years) was 0.440 for males [95% CI: 0.438-0.442] and 0.180 for females [95% CI: 0.178-0.181].

In the adolescence (15-24 years) the cumulative risk was 0.192 [95% CI: 0.188-0.195] for males, and 0.048 [95% CI: 0.046-0.051] for females, respectively.

9.4. Results of study 4

9.4.1. The feasibility of register merging

By employing the Danish Civil Registration System it was possible to select 53,986 population-based controls frequency matched on age, gender, and year from the background population of Odense Municipality. Only in five cases (0.1 %), elderly persons of 93 years or older, it was not possible to select five matching controls, owing to a very small number of matching controls in the background population.

It was also possible by using the cpr-number to merge and extract relevant data regarding adult victims of violence from the A&E department and/or the IFM with demographic and socioeconomic data from two national longitudinal registers at Statistics Denmark. A thorough recoding of extracted variables, construction of new variables, and exclusion of less usable variables (due to a high number of missing value, data regarding only a limited part of the study period, or inconsistencies in coding) made it possible to build robust models for analyses of demographic and socioeconomic risk factors for violent victimization.

9.4.2. Demographic and socioeconomic risk factors

Overall, the size and direction of the odds ratios for the unadjusted analyses and the semi-adjusted analyses did not differ. Therefore, only the results of the semi-adjusted analyses are shown in the tables and mentioned in the result section. Tables 9.1 and 9.2 show the number of cases and controls, the results of the semi-adjusted analyses of personal model and family model of risk factors for A&E department and/or IFM contact due to violent victimization.

In the semi-adjusted analyses *personal factors* strongly associated with A&E department and/or IFM contact due to adult violent victimization were: being a pensioner (OR: 4.70; 95% CI: 4.35-5.07), living without a partner (OR: 3.24; 95% CI: 3.09-3.40), high lifetime unemployment rate (OR: 2.44; 95% CI: 2.33-2.55), and citizenship of a country outside Europe (OR: 1.79; 95% CI: 1.60-2.00). Important personal factors negatively associated with A&E department and/or IFM contact due to adult violent victimization were: being self-employed or a manager (OR: 0.29; 95% CI: 0.27-0.31), being a skilled or unskilled worker (OR: 0.45; 95% CI: 0.43-0.47), and being a student (OR: 0.52; 95% CI: 0.47-0.58).

In the semi-adjusted analyses *family factors* strongly associated with A&E department and/or IFM contact due to adult violent victimization were: annual household gross income of less than 10,000 € (OR: 6.93; 95% CI: 6.37-7.55), annual household gross income between 10,000 € and 19,999 € (OR: 5.19; 95% CI: 4.81-5.60), annual household gross income between 20,000 € and 29,999 € (OR: 1.98; 95% CI: 1.83-2.15), and living without children (OR: 1.96; 95% CI: 1.86-2.08). Conversely, important family factors negatively associated with A&E department and/or IFM contact due to adult violent victimization were: a household crowding of 25-49 m^2 per resident (OR: 0.70; 95% CI: 0.66-0.74) and an age difference to partner of five years or more (OR: 0.82; 95% CI: 0.77-0.88).

Table 9.3 shows the results of the fully adjusted analyses of *personal and family risk factors* in the combined model. The risk factors most strongly associated with A&E department and/or IFM contact due to adult violent victimization were: not living with a partner (OR: 2.93; 95% CI: 2.74-3.13), annual household gross income of less than 10,000 € (OR: 2.38; 95% CI: 2.16-2.63), high lifetime unemployment rate (OR: 1.92; 95% CI: 1.82-2.02), annual household gross income between 10,000 € and 19,999 € (OR: 1.87; 95% CI: 1.71-2.04), household crowding of less than 24 m^2 per resident (OR: 1.86; 95% CI: 1.68-2.05), age difference to partner of five years or more (OR: 1.56; 95% CI: 1.43-1.69), and being a pensioner (OR: 1.49; 95% CI: 1.36-1.63). The most important factors negatively associated with A&E department and/or IFM contact due to adult violent victimization were: being a student (OR: 0.23; 95% CI: 0.20-0.26), being self-employed or a manager (OR: 0.32; 95% CI: 0.29-0.35), and being a skilled or unskilled worker (OR: 0.45; 95% CI: 0.42-0.48).

In the semi-adjusted analysis foreign citizenship in a country outside Europe was significantly associated with A&E department and/or IFM contact due to adult violent victimization (OR: 1.79; 95% CI: 1.60-2.00). Adjusting for all other variables included in the fully adjusted analyses diminished the association to an insignificant level (OR: 1.08; 95% CI: 0.96-1.22).

9.4.3. Interactions

The analysis of interactions in the final model revealed very few indications of significant interactions. When including interaction with household gross income a two-fold increase in the OR for violent victimization was observed for non-Danish and non-European individuals (OR: 2.04; 95%: 1.01-4.17). A similar two-fold increase in the OR of violent victimization was observed for individuals living without a partner when including interaction with the variable “children” (OR: 5.97; 95% CI: 5.31-6.71).

When including interactions with the categories “household gross income” and “children” the ORs for violent victimization among students changed to an insignificant level (OR: 0.92; 95%: 0.27-3.20) and (OR: 0.90; 95%: 0.68-1.20). Similarly, the ORs for violent victimization among pensioners changed to insignificant levels when including interactions with the categories “household gross income” and (OR: 1.18; 95%: 0.73-1.91) and “household crowding” (OR: 1.08; 95%: 0.94-1.26).

Household gross income had interactions with two variables. The ORs for violent victimisation among individuals with low income (0-9,999 €) and moderate income (10,000-19,999 €) decreased significantly when interaction with age was included (OR: 0.34; 95% CI: 0.20-0.59) and (OR: 0.56; 95% CI: 0.31-1.01). Additionally, when including the variable “children” in the model the OR for violent victimization increased significantly for individuals with low income (0-9,999 €) (OR: 7.16; 95% CI: 5.94-8.61) and moderate income (10,000-19,999 €) (OR: 3.15; 95% CI: 2.70-3.68).

When including interaction with household gross income the ORs for violent victimization among individuals with high or moderate level household crowding changed to an insignificant level (OR: 1.16; 95% CI: 0.82-1.63) and changed direction (OR: 0.80; 95% CI: 0.67-0.95), respectively. Similarly, the ORs for violence among individuals with high or moderate level household crowding changed to an insignificant level and changed direction when including interaction with the category children (OR: 0.90; 95% CI: 0.63-1.28) and (OR: 0.65; 95% CI: 0.46-0.92).

In conclusion inclusion of interactions in extension of the final model revealed a more complex structure of associations between income and age and citizenship.

Table 9.1. The personal model of risk factors for A&E department and/or IFM contact due to adult violent victimization: number of subjects, odds ratios (ORs), and 95 % CI.

	Cases N=10,799 (%)	Controls N=53,986 (%)	ORs [95% CI] Semi-adjusted†
Citizenship			
Danish	9872 (91.4)	50,323 (93.2)	1.00 (reference)
Other European	366 (3.4)	1719 (3.2)	1.08 (0.97-1.22)
Other World	447 (4.1)	1277 (2.4)	1.79 (1.60-2.00)*
No information	114 (1.1)	667 (1.2)	0.87 (0.71-1.07)
Partnership			
Living with partner	3191 (29.6)	29,238 (56.2)	1.00 (reference)
Not living with partner	7608 (70.4)	24,748 (45.8)	3.24 (3.09-3.40)*
Student			
Student	419 (3.9)	3767 (7.0)	0.52 (0.47-0.58)*
Not student	10,320 (95.5)	49,809 (92.2)	1.00 (reference)
No information	60 (0.6)	410 (0.8)	0.69 (0.53-0.91)*
Pensioner			
Pensioner	1822 (16.9)	3394 (6.3)	4.70 (4.35-5.07)*
Not pensioner	8917 (82.5)	50,182 (92.9)	1.00 (reference)
No information	60 (0.6)	410 (0.8)	0.78 (0.60-1.03)
Skilled or unskilled worker			
Skilled/unskilled worker	3899 (36.1)	29,468 (54.6)	0.45 (0.43-0.47)*
Not skilled/unskilled worker	6840 (64.3)	24,108 (44.6)	1.00 (reference)
No information	60 (0.6)	410 (0.8)	0.49 (0.37-0.65)*
Self-employed or manager			
Self-employed/manager	630 (5.8)	9072 (16.8)	0.29 (0.27-0.31)*
Not self-employed/manager	10,109 (93.6)	44,504 (82.4)	1.00 (reference)
No information	60 (0.6)	410 (0.8)	0.66 (0.50-0.87)*
Lifetime unemployment			
Lower than half	3568 (33.0)	28,589 (52.9)	1.00 (reference)
Upper half	7171 (66.4)	24,987 (46.3)	2.44 (2.33-2.55)*
No information	60 (0.6)	410 (0.8)	1.20 (0.91-1.58)

†) Adjusted for age, gender, and year of violence
*) P-value<0.01

Table 9.2. The family model of risk factors for A&E department and/or IFM contact due to adult violent victimization: number of subjects, odds ratios (ORs), and 95 % CI.

	Cases N=10,799 (%)	Controls N=53,986 (%)	ORs [95% CI] Semi-adjusted†
Age difference			
0 – 4 years	9511 (88.1)	46,407 (86.0)	1.00 (reference)
5 years or more	1288 (11.9)	7579 (14.0)	0.82 (0.77-0.88)*
Children			
Living with children	2332 (21.6)	17,082 (31.6)	1.00 (reference)
Not living with children	8407 (77.8)	36,494 (67.6)	1.96 (1.86-2.08)*
No information	60 (0.6)	410 (0.8)	1.24 (0.94-1.63)
Household gross income			
0 – 9999 € per year	3124 (28.9)	9335 (17.3)	6.93 (6.37-7.55)*
10,000 – 19,999 € per year	4606 (42.6)	15,571 (28.8)	5.19 (4.81-5.60)*
20,000 – 29,999 € per year	2046 (19.0)	15,799 (29.3)	1.98 (1.83-2.15)*
30,000 € per year ore more	963 (8.9)	12,871 (23.8)	1.00 (reference)
No information	60 (0.6)	410 (0.8)	2.69 (2.03-3.57)*
Household Crowding			
0 – 24 m^2 per resident	1080 (10.0)	4203 (7.8)	1.13 (1.04-1.22)*
25 – 49 m^2 per resident	3575 (33.1)	22,403 (41.5)	0.70 (0.66-0.74)*
50 – 74 m^2 per resident	2834 (26.2)	12,625 (23.4)	1.00 (0.94-1.06)
75 m^2 per resident or more	3108 (28.8)	13,970 (25.9)	1.00 (reference)
No information	202 (1.9)	785 (1.4)	1.15 (0.98-1.35)

†) Adjusted for age, gender, and year of violence
*) P-value<0.01

Table 9.3. The combined final model of risk factors for A&E department and/or IFM contacts due to adult violent victimization: odds ratios (ORs) of multivariate analyses and significant interactions.

	ORs [95% CI] Fully adjusted‡	Interaction#
Citizenship		Household gross income
Danish	1.00 (reference)	
Other European	0.84 (0.74-0.95)*	
Other World	1.08 (0.96-1.22)	
No information	0.62 (0.45-0.84)*	
Partner		Children
Living with partner	1.00 (reference)	
Not living with partner	2.93 (2.74-3.13)*	
Student		Income Children
Student	0.23 (0.20-0.26)*	
Not student	1.00 (reference)	
No information	0.73 (0.46-1.17)	
Pensioner		Income Household crowding
Pensioner	1.49 (1.36-1.63)*	
Not pensioner	1.00 (reference)	
No information	0.73 (0.46-1.17)	
Skilled or unskilled worker		None
Skilled/unskilled worker	0.45 (0.42-0.48)*	
Not skilled/unskilled worker	1.00 (reference)	
No information	0.73 (0.46-1.17)	
Self-employed or manager		None
Self-employed/manager	0.32 (0.29-0.35)*	
Not self-employed/manager	1.00 (reference)	
No information	0.73 (0.46-1.17)	
Lifetime unemployment		None
Lower half	1.00 (reference)	
Upper half	1.92 (1.82-2.02)*	
No information	0.73 (0.46-1.17)	

‡) Adjusted for age, gender, year of violence, and all other variables included in the final model.
*) P-value<0.01.
#) Interactions

Table 9.3. The combined final model of risk factors for A&E department and/or IFM contacts due to adult violent victimization: odds ratios (ORs) of multivariate analyses and significant interactions.[CONTINUED]

	ORs [95% CI] **Fully adjusted‡**	**Interactions#**
Age difference		None
0 – 4 years	1.00 (reference)	
5 years or more	1.56 (1.43-1.69)*	
Children		None
Living with children	1.00 (reference)	
Not living with children	1.12 (1.05-1.21)*	
No information	0.73 (0.46-1.17)	
Household gross income		Age Children
0 – 9999 € per year	2.38 (2.16-2.63)*	
10,000 – 19,999 € per year	1.87 (1.71-2.04)*	
20,000 – 29,999 € per year	1.34 (1.23-1.46)*	
30,000 per year ore more	1.00 (reference)	
No information	0.73 (0.46-1.17)	
Household Crowding		Income Children
0 – 24 m^2 per resident	1.86 (1.68-2.05)*	
25 – 49 m^2 per resident	1.34 (1.25-1.43)*	
50 – 74 m^2 per resident	1.18 (1.11-1.26)*	
75 m^2 per resident or more	1.00 (reference)	
No information	1.54 (1.24-1.91)*	

‡) Adjusted for age, gender, year of violence, and other variables included in the final model.
*) P-value<0.01.
#) Interactions

9.5. Results of study 5

In the one-year study period 1403 victims of violence from Odense Municipality attended the A&E department at OUH and/or were recorded by the police. Figure 9.1 shows the number of victims registered at the A&E department, the police, or both.

Figure 9.1. The number of victims registered at the A&E department, the police, or both.

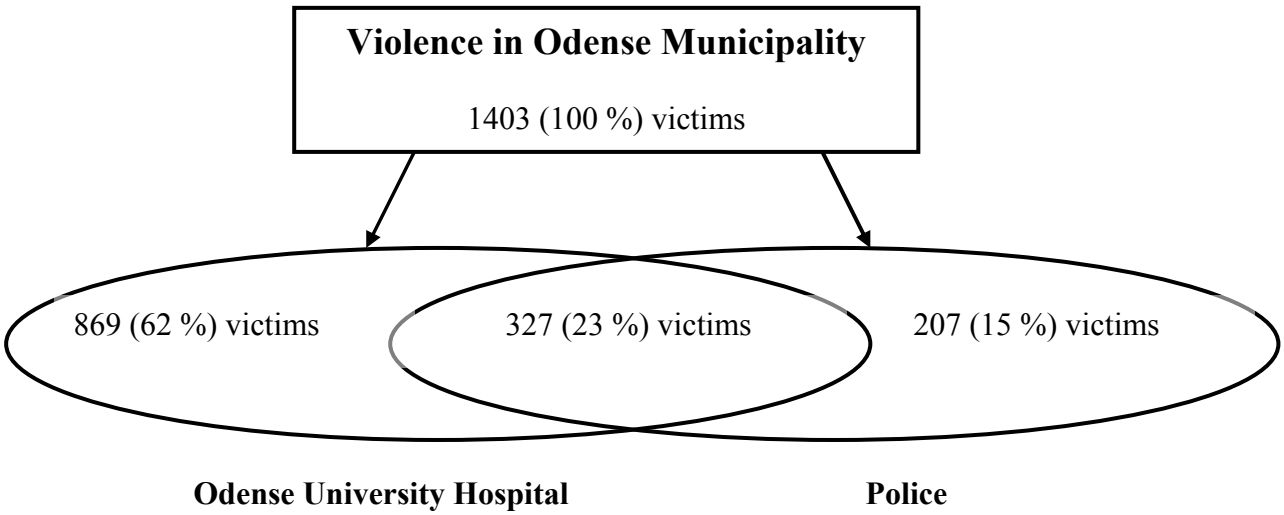


Table 9.4 shows the proportion of all A&E department and/or police registered victims of violence who were registered in the A&E department, stratified by gender. A total of 87 % of all registered male victims and 82 % of all registered female victims were registered at the A&E department (Fisher's exact, p=0.015).

Overall, the proportion varied little with age group, place of violence, weekday, time, counterpart, and weapon use. However, for both males and females smaller proportions of victims were recorded at the A&E department among the elderly (60 % vs. 73 %) and among victims who suffered from firearm injuries (62 % vs. 50 %). High proportions were observed among males if the place of violence was unknown (95 %), the day of violence was unknown (100 %), the time of violence was unknown (98 %), the counterpart was a current partner (100 %) or the police (100 %), or if a sharp object was used (96 %). A high proportion was observed among females if the counterpart was the police (100 %),

Table 9.5 shows the proportion of all A&E department and/or police registered victims of violence who were registered by the police, stratified by gender. Overall 35 % of the male victims and 44 % of the female victims were registered in the police records (Fisher's exact, p=0.003).

The proportion varied with age group, place of violence, weekday, time, counterpart, and weapon use. Generally, for those cases where the circumstances of the incidents were "unknown" to the victim, the percentage of reporting to the police was low. Additionally, low proportions were observed among males and females aged 0-14 years (29 % vs. 32 %), among males injured in their home (29 %), among males and females injured by a current partner (29 % vs. 36 %) or another family member (20 %), or among male victims injured without weapon use (20 %). High proportions were observed among males and females aged 60 years or more (70 % vs. 53 %), among females injured by a former partner (57 %), and among males and females injured by firearms (62 % vs. 50 %) or sharp objects (44 % vs. 52 %).

Table 9.6 shows the number of victims registered at the A&E department and the percentage of those who were also recorded by the police, stratified by gender. The overall proportion of victims attending the A&E department and also recorded by the police was 27 %. For males and females the proportion was 26 % and 31 %, respectively (Fisher exact, p=0.048).

High percentages of reporting to the police were observed among males aged 60 years or more (50 %), among females injured by a former partner (45 %) or another family member (37 %), and among males injured with firearms (38 %) and males and females injured with sharp objects (42 % vs. 44 %). Low percentages of police reporting were observed among males and females aged 0-14 years (14 % vs. 8 %), among females aged 60 years or more (18 %), among males and females if the place of violence was unknown to the victim (10 % vs. 0 %), among females if the time of violence was unknown to the victim (21 %), among males injured by another family member (23 %), among females injured by a current partner (13 %), and among males and females if the use of weapon was unknown to the victim (17 % vs. 15 %).

Table 9.4. The proportion of all A&E department and/or police registered victims of violence who were registered in the A&E department stratified by gender.

	Males			Females		
	All	OUH		All	OUH	
	N	%	[95 % CI]	N	%	[95 % CI]
Age group						
0 – 14 years	72	82	62 – 106	38	84	58 – 119
15 – 24 years	403	88	79 – 97	148	80	67 – 96
25 – 39 years	293	88	78 – 100	149	81	67 – 97
40 – 59 years	170	87	74 – 102	95	85	68 – 106
60 – years	20	60	31 – 105	15	73	37 – 131
Place of violence						
Public area	771	86	79 – 93	210	80	69 – 94
Victims home	84	92	2 – 115	176	85	72 – 99
Other's home	82	89	0 – 112	56	79	50 – 119
Unknown	21	95	58 – 147	3	67	8 – 241
Weekday						
Monday – Thursday	337	85	76 – 96	211	84	72 – 97
Friday – Sunday	617	88	80 – 95	229	81	70 – 93
Unknown	4	100	27 – 256	5	40	5 – 144
Time						
08.00 – 15.59	144	78	64 – 94	94	85	67 – 106
16.00 – 23.59	347	84	75 – 94	203	79	68 – 93
24.00 – 07.59	403	91	81 – 100	119	83	68 – 101
Unknown	64	98	6 – 126	29	83	53 – 123
Counterpart						
Unknown person	623	85	77 – 93	124	78	62 – 97
Current partner	14	100	55 – 168	98	84	67 – 104
Former partner	6	83	27 – 194	76	82	63 – 105
Another family member	25	92	58 – 138	22	86	52 – 135
Acquaintance	195	86	74 – 100	77	82	63 – 105
Police	16	100	57 – 16	1	100	3 – 557
Other	79	92	78 – 108	47	83	63 – 107
Weapon use						
No weapon	707	85	79 – 92	399	81	73 – 91
Firearm	13	62	7 – 121	2	50	1 – 279
Sharp object	104	96	78 – 117	21	86	51 – 135
Club etc.	65	89	68 – 115	9	89	38 – 175
Unknown	69	91	70 – 117	14	93	49 – 159
All	958	87	81 – 93	445	82	74 – 91

Table 9.5. The proportion of all A&E department and/or police registered victims of violence who were registered by the police stratified by gender.

	Males			Females		
	All	Police		All	Police	
	N	%	[95 % CI]	N	%	[95 % CI]
Age group						
0 – 14 years	72	29	18 – 45	38	32	16 – 55
15 – 24 years	403	38	32 – 44	148	47	37 – 60
25 – 39 years	293	33	27 – 41	149	47	37 – 59
40 – 59 years	170	31	23 – 41	95	39	27 – 54
60 – years	20	70	38 – 117	15	53	23 – 105
Place of violence						
Public area	771	37	32 – 41	210	45	36 – 55
Victims home	84	29	18 – 42	176	42	34 – 53
Other's home	82	37	25 – 52	56	45	29 – 66
Unknown	21	14	3 – 42	3	33	1 – 186
Weekday						
Monday – Thursday	337	31	25 – 38	211	39	31 – 48
Friday – Sunday	617	38	33 – 43	229	48	39 – 58
Unknown	4	0	-	5	60	12 – 175
Time						
08.00 – 15.59	144	38	28 – 49	94	39	28 – 54
16.00 – 23.59	347	42	36 – 49	203	49	40 – 60
24.00 – 07.59	403	34	29 – 40	119	45	33 – 58
Unknown	64	2	0 – 9	29	17	6 – 40
Counterpart						
Unknown person	623	36	32 – 41	124	42	31 – 52
Current partner	14	29	8 – 73	98	36	25 – 50
Former partner	6	33	4 – 120	76	57	41 – 76
Another family member	25	20	6 – 47	22	45	22 – 84
Acquaintance	195	36	28 – 45	77	44	31 – 62
Police	16	0	-	1	0	-
Other	79	39	27 – 56	47	45	28 – 68
Weapon use						
No weapon	707	20	17 – 24	399	52	45 – 60
Firearm	13	62	27 – 121	2	50	1 – 279
Sharp object	104	44	32 – 59	21	52	26 – 94
Club etc.	65	38	25 – 57	9	44	12 – 114
Unknown	69	25	14 – 39	14	21	4 – 63
All	958	35	32 – 39	445	44	38 – 50

Table 9.6. The number of victims attending the A&E department and the percentage also recorded by the police stratified by gender.

	Males			Females		
	OUH	Police recorded		OUH	Police recorded	
	N	%	[95 % CI]	N	%	[95 % CI]
Age group						
0 – 14 years	59	14	6 – 27	32	8	7 – 41
15 – 24 years	354	29	24 – 36	119	34	25 – 47
25 – 39 years	259	25	19 – 32	121	35	25 – 47
40 – 59 years	148	21	14 – 30	81	28	18 – 43
60 – years	12	50	18 – 108	11	18	2 – 66
Place of violence						
Public area	662	26	22 – 30	169	31	23 – 41
Victims home	77	22	13 – 35	149	32	24 – 43
Other's home	73	29	18 – 44	44	30	16 – 51
Unknown	20	10	1 – 36	2	0	-
Weekday						
Monday – Thursday	288	19	15 – 25	177	27	20 – 36
Friday – Sunday	540	29	25 – 34	185	36	28 – 45
Unknown	4	0	-	2	0	-
Time						
08.00 – 15.59	112	20	12 – 30	80	29	18 – 43
16.00 – 23.59	292	31	25 – 38	161	36	27 – 47
24.00 – 07.59	365	28	22 – 33	99	33	23 – 47
Unknown	63	0	-	24	21	7 – 49
Counterpart						
Unknown person	453	28	22 – 32	79	32	20 – 47
Current partner	14	29	8 – 73	82	23	14 – 36
Former partner	5	20	1 – 111	62	45	31 – 67
Another family member	23	13	3 – 38	19	37	15 – 76
Acquaintance	235	26	20 – 34	98	30	20 – 42
Police	16	0	-	1	0	-
Other	86	26	16 – 39	23	22	7 – 51
Weapon use						
No weapon	603	23	19 – 27	324	31	25 – 38
Firearm	8	38	8 – 110	1	0	-
Sharp object	100	42	30 – 57	18	44	19 – 88
Club etc.	58	31	18 – 49	8	38	8 – 110
Unknown	63	17	9 – 31	13	15	2 – 56
All	832	26	22 – 29	364	31	26 – 38

10. METHODOLOGICAL DISCUSSION

10.1. The sampling of A&E department data in studies 1-5

10.1.1. Selection bias

No generally accepted definition of deliberate interpersonal violence is available for use in the A&E department. The registration of violence in the A&E department is dependent on an inter-observer variation in the definition of the individual staff member. However, the definition used in this study is consistent with a "common sense" definition of violence which can be easily applied to an A&E department population. A specific problem arises when it comes to violence among children where it can be difficult to decide whether a certain incident is an incident of violence or an accident. This may lead to an underestimation of the frequency of violence among children.

A possible selection bias is that we had no information available about victims of violence seeking medical attention at the general practitioners, at neighbouring hospitals, or not at all. Furthermore, we did not have access to data about those who were solely registered by the police. Previous studies have shown that the vast majority of assault victims who seek medical attention do so at the A&E departments.[25,30,31]

Odense Municipality is well-defined geographically, and the open access A&E department at OUH is the only institution of its kind in the municipality. The A&E department is open 24 hours a day and is located in the city centre, which limits the proportion of victims attending the general practitioners. Furthermore, an analysis of the study region and the neighbouring municipalities has shown that only 2 % of all victims of violence from Odense Municipality seek medical attention in the nearest neighbouring hospitals 45 kilometres away.[167] No changes in the referral principles or organisation of treatment of injury patients in the study region have been made in the study period. Furthermore, the results from study 5 revealed that about 15 % of all registered victims in Odense Municipality are solely registered in the police records.

Unfortunately, we have no information about the victims who are not registered in the health care systems or in the police records. A Norwegian study showed that of those who had been exposed to physical violence during the preceding year, only 24 % had sought medical treatment.[168] Especially victims of violence in a dependent relationship with the perpetrator, which is the case with intimate partner violence and child abuse, may be underrepresented in our study due to the sampling methods.

A specific problem arises because of possible changes in victims' behaviour in seeking medical attention in the study period. Such changes may influence the time trends in the frequency and severity of violence. In the study period police reported violence in Odense Municipality increased with 50 %.[17] The results of our study have shown that the incidence rate of contacts with the A&E department and/or IFM stayed unchanged in the study period. This indicates that the rise in the frequency of police reported violence is caused by an increased tendency to report violence. Similar changes in the victims' behaviour when it comes to seeking medical attention may have occurred. For example, the apparent lack of acceptance of violence among the victims, which leads to an increased frequency in reporting to the police, may also lead to a lower threshold for seeking medical attention in the A&E department. A lower threshold may lead to an increasing trend in incidence and a decreasing trend in severity due to more attendances with minor injuries. Additionally, changes in whether victims attend the A&E department or a general practitioner may influence the time trends in violence.

The threshold of seeking medical attention because of injuries from violence may vary with demographic and socioeconomic background. Studies have revealed that attendance rates to A&E departments after injury depend on factors such as distance to the A&E department, age, gender, and ethnicity.[36,37,169] However, no previous study has addressed the size and direction of this problem regarding violent injuries. Therefore, the extent and direction of such a bias is unknown.

Some victims of violence may have been admitted to hospital without prior evaluation in the A&E department. Studies have indicated that few assault victims are taken directly to hospital without prior evaluation in the A&E department.[25,65] Therefore, biases from that are less likely.

The A&E department registration of child abuse represents a specific problem. Children who have suffered from abuse or are suspected of being victims of abuse are frequently admitted directly to the paediatric ward for evaluation and treatment without prior evaluation in the A&E department. We have no reliable information available about the extent of the problem which may lead to an underestimation of the frequency of violence against children.

10.1.2. Information bias

All registration of injury patients in the A&E department at OUH are based on the NOMESCO classification of external causes of injuries.[7] In contrast to most other A&E departments in Denmark all registrations are carried out by a trained secretary staff, and members of this staff are on duty 24 hours a day. All registrations are consecutively evaluated for misclassifications and errors by

specially trained secretaries the following day. Although all registered information may be subject to misclassification or registration errors, we believe that the current registration system limits the extent of misclassifications and errors.

The workload of the A&E department varies greatly, and it is probable that registration errors may be dependent of the workload, the time of day, the persons on duty, etc. It is unclear whether and to what extent this has lead to any bias in the study. So far no study has attempted to address this problem.

A weakness of the A&E department registration is that it is completely dependent on self-report by the patients and that the registration of patients with injuries from violence requires that the patients disclose the information that the injuries were caused by an assault. Therefore, some victims of assault may be misclassified as victims of other causes of injuries and vice versa. It is more likely that victims wrongly state other causes than violence in order to conceal the violence than vice versa. We have no information of the extent of this misclassification. Especially violence occurring in a dependent relationship of the victim with the perpetrator may be concealed. Studies have shown that a large proportion of female victims of domestic violence are unrecognised as such in the A&E department.[96,170] Additionally, victims may deliberately disclose incorrect information about the incident of violence such as location of violence, time of violence, use of weapon etc.

The interview of the victims by the A&E department staff is always carried out immediately after the victim has arrived at the A&E department, and studies have shown that most of the medical treatment takes place shortly after the assault.[56,65,168] Therefore, a bias due to slips of the memory is less likely. However, many assault victims are influenced by alcohol during their initial encounter with the A&E department.[52,53,125,135-137,171] The consumption of alcohol in many victims may influence their credibility as informants.

The diagnoses registered were based on ICD8 and ICD10 codes.[8,9] All coding of diagnoses was carried out by the physicians who examined and treated the victims. The registrations of diagnoses are subject to both inter-observer observation and registration errors. However, before analysing the data the diagnoses were merged/bulked together in broad categories describing type and location of lesions. Although inter-observer variations and registration errors may still influence the results of our study, we believe that the broad categories analysed may limit the extent of systematic biases.

Because of a maximum number of five injuries recorded for each victim some injuries among patients with multiple injuries are missing in the registration. However, only 1 % of all victims in our study had five injuries registered and the majority of these injuries were of a minor severity.

Therefore, we believe that the restricted number of registered injuries has a limited impact on the results of the study.

10.1.3. Bias due to registration of repeat violent victimization

Although, a five year run-in period was taken into account misclassifications of non-repeat victims and index contacts may still have occurred as victims identified as non-repeat victims may have had an earlier contact with the A&E department prior to the run-in period, and the index contact, therefore, may not be the overall first contact with the A&E department. Prior to the study we took different run-in periods into account in order to obtain an optimal run-in period length. Analyses revealed that a longer run-in period revealed only few more misclassifications (see section 7.2 and Appendix D and E).

The estimated recurrence proportions in the study refer only to recurrence proportions of victims attending one A&E department and one IFM during the twelve year period. Obviously, victims from Odense Municipality may have had contact with other A&E departments and/or IFMs in Denmark due to injuries from violence.

In line with the study design the follow-up time ranged from zero (victimized December 31, 2002) to twelve years (victimized 1 January 1991). The follow-up time varied because some victims died due to causes unrelated to violence in the twelve year study period and due to immigration and/or emigration from the municipality. Therefore, the results refer to a recurrence proportion during a twelve year time period and not the recurrence proportion in a twelve year follow-up period.

10.1.4. Bias related to the estimation of lifetime risk

In the estimation of cumulative risks including lifetime risk, the assumption of time homogeneity implies stable incidence and survival rates.[159] Accordingly, the obtained cumulative risk estimates should be interpreted as estimates pertaining to a hypothetical population subject to the age-specific victimization and mortality rates observed in the study period. The observed decrease in age-specific victimization rates among males similarly implies that the lifetime risk should be interpreted as the average lifetime risk over the period. Any assumptions of time homogeneity of such basic parameters in a population over a century are very rough in most practical situations. However, several methods in modern epidemiology are based on time homogeneity assumptions, and we find that the estimates are still useful for comparing populations across time and location.

10.1.5. Bias related to register data from Statistics Denmark

The information about age and gender has very high reliability. All individuals living in Denmark are assigned a cpr-number, which contains information about gender and date of birth. Specific problems may arise among immigrants from some third world countries who are not able to give exact information about their date of birth. However, errors arising from this phenomenon are probably limited due to a low number of individuals from such countries in the study.

Also, information regarding citizenship status may have very high reliability due to the Danish authorities' strict politics about immigration and immigration registration.

Information regarding unemployment has high reliability.[172] However, the information regarding unemployment covers only individuals aged 16 to 66 years. Due to compulsory school attendance until the 9th grade it should not be possible that adolescents aged 15 or less are registered as unemployed. Although the age of retirement in Denmark is 65 years, some elderly persons stay longer on the labour market and may also be candidates of unemployment. Another possible selection bias arises as only unemployed persons receiving unemployment benefit or other monetary compensation due to unemployment are registered. We have no information about the extent of these selection biases which may all lead to an underestimation of the unemployment rates.

The information about income is based on the reporting of gross income from the Danish tax authorities.[172] Gross income is the summarized income from work, social pensions, unemployment benefits, and other transfer incomes. Income from shares, tax-free incomes, housing benefits and child benefits are not included. Additionally, undeclared work is not included and misstated or insufficient reporting to the tax authorities may give rise to information bias. All the biases mentioned may underestimate the gross income.

The information regarding household (partnership and children) and household crowding (housing size and number persons in household) has high reliability.[173] However, the information is dependent on the extent of the reporting of the correct home address to the authorities. Secondly, all people living in Denmark must have a registered address even though they are living as homeless people, etc. Unfortunately, no reliable information is available about the extent and direction of these biases.

The information regarding socioeconomic status (student, pensioner, worker etc.), which is based on data from several other registers in Statistics Denmark, has moderate to high reliability.[174,175]

The reliability of the information is dependent on correct links between the different data sources. Unfortunately, no information regarding the extent and direction of such bias are available.

10.1.6. Violence typology

Unfortunately, we had no reliable information about the perpetrator(s), including the victims' relation to the perpetrator(s) for the study period 1991-2002. Therefore, the results of studies 1-4 refer to all types of violence. Based on the data collected by the A&E department and/or IFM we were not able to analyse different violence typologies separately such as community violence and domestic violence. The problem is well known from other routine A&E department registration systems.[33] It is our hope that we will be able to implement the specific NOMESCO codes for event of violence in the routine registration system at the A&E department at OUH for use in future studies.[7]

10.2. Sampling of IFM data in studies 1-4

10.2.1. Selection bias

Like in most other Western countries, (probably) all deaths from deliberate interpersonal violence are subject to a detailed medico-legal autopsy at the IFMs. The IFM at SDU is the only institution of its kind in the municipality and services not only Odense Municipality, but also Funen County and the Southern part of Jutland. Therefore, selection bias affecting the data from the IFM is less likely.

Additionally, in the study period approximately 30 physical examinations of victims of sexual assault were carried out at the IFM at SDU who were not included in the study. Less than half of these were residents of Odense Municipality.

10.2.2. Information bias

Misclassifications and registration errors may have occurred. Violence may wrongly have been taken for suicides or accidents or vice versa leading to misclassification of cause of death. All information regarding victims from the IFM was obtained from the autopsy reports by the author. The data were separately entered twice in Epidata 3.1© by the author.[162] The contents of the two

files were compared using the Epidata option and discrepancies were corrected. We believe that the extent to which this information bias may affect the results is limited.

10.3. Sampling of A&E department and IFM data in study 5

10.3.1. Selection bias and information bias

The data from the A&E department and the IFM used in study 5 may be affected by the same biases as described in sections 10.1.1, 10.1.2, 10.2.1, and 10.2.2.

All data were separately entered twice in Epidata 3.1© by the author, the contents of the two files were compared, and discrepancies were corrected.[162] Additionally, the cpr-number, which was used as a key for merging data, was validated. This limits the extent of errors.

10.4. Sampling of police data in study 5

10.4.1. Selection bias

Selection bias may influence the police recorded data due to the limited proportion of all victims being registered in the police reports. Several factors may influence the decision to report a crime including fear of reprisals, a continuing relationship with the offender, hostility towards the police, a perception that the behaviour did not constitute a crime, and inability to identify the offender. Therefore, it is very likely that a specific group of victims such as victims in a dependent relationship with the perpetrator, victims with a criminal background, prostitutes, victims with a substance abuse, and victims with bad experiences concerning the police do not report violence to the police. Furthermore, the decision of reporting to the police may change with time (see section 4.11.1). However, in our study the aim was to describe the completeness of the data registered by the A&E department and to estimate the proportion of victims who also report the incident to the police. Therefore, the mentioned selection biases are less relevant.

10.4.2. Information bias

Misclassifications and registration errors may have occurred. All information regarding victims from the police was obtained from the police reports, and the registration forms were filled in by

members of the police staff (see Appendix C). All data were separately entered twice in Epidata 3.1© by the author, the contents of the two files were compared, and discrepancies were corrected.[162] Additionally, the cpr-number, which was used as a key for merging data, was validated. This limits the extent of errors.

11. DISCUSSION OF RESULTS

11.1. Study 1 – Frequency and severity

11.1.1. Age and gender

In our study attendances due to violence represented 3.6 % of all injury attendances at the A&E department. In other Danish studies the percentage varied between 1.8 % and 4.1 %.[30,38-40,45,50] In international studies the percentage varied between 1.3 % and 4.7 %.[54,57,59-61,65,67,70] Additionally, the age and gender distributions are consistent with those of other studies.[27,30,32,38-40,45,49,50,54-57,59-63,65,67-70]

11.1.2. Frequency of violence

Both the overall and the gender specific annual incidence rates in our study are partly consistent with the incidence rates in other A&E department studies. Previous Danish studies have shown an overall incidence rate of violence between 3.3 and 9.0 per 1000 population/year.[32,40,49,50] International studies have revealed overall incidence rates between 2.5 and 5.1 per 1000 inhabitants/year.[59,61,62,64,69] In A&E department studies the gender specific incidence rates varied between 3.6 and 13.4 per 1000 population/year for males and between 0.7 and 4.7 per 1000 population/year for females.[31,32,40,61,69]

In our study males had a threefold higher overall annual incidence rate than females and the highest incidence rate was in the adolescence (15-24 years) for both males and females, which is also consistent with other studies.[31,32,49,69]

In the study period the overall annual incidence rate decreased significantly among males and among females in the age groups 25-39 years, whereas the incidence increased among females in the age group 15-24 years. Few other studies have attempted to describe changes in the incidence rate of violence. In a former study of victims from Odense Municipality attending the A&E department at OUH, the overall incidence rate declined from 8.4 to 5.7 per 1,000 population/year in the period 1988-1996.[21] The present study shows that this trend has stabilized. In studies from Aarhus the overall incidence rate decreased from 6.5 to 4.6 per 1,000 population/year in the period from 1981-1982 to 1999-2000.[49] Similarly, data from the Norwegian Injury Sample Registry have

shown a 15-20 % decrease in the overall incidence of violence in four Norwegian cities in the period 1990 to 1999.[64] A prospective study from 58 A&E departments in England and Wales from 1995 to 2000 showed no significan changes in the incidence rates of violence throughout the period except among females aged 11-17 years, who experienced an increased incidence rate.[62]

11.1.3. Injuries and severity of violence

The majority of the lesions in our study were in the head or neck and upper limbs, whereas lesions in the thorax or the abdomen accounted for less than 1/10 of the lesions. For both males and females 3/4 of the lesions were less serious lesions or wounds, whereas deeper and potentially dangerous lesions accounted for only 2-3 %. Other papers have shown the same distribution of lesions according to body region and type of lesion.[27,28,38-40,43,45,51,53-57,59,61,63-66,68-70,155]

We did not find any rise in the percentage of more severe lesions such as bone fractures or deep lesions in the study period. On the contrary, the percentage of bone fractures and deep lesions decreased slightly, whereas the percentage of less serious lesions increased for both males and females. The third Aarhus study Brink found no significant change in the type or location of injuries in the study periods 1981-82, 1987-88, and 1993-94.[28]

Penetrating injuries due to stab/cut wounds and gunshot wounds are relatively uncommon in Scandinavia.[176-178] In our study 3.0 % of all incidents involved injuries due to stabs or cuts with a knife, and 0.4 % involved injuries from firearms. Previous Scandinavian studies have shown the similar proportions of weapon use.[28,38,43,51,65,67,68] The proportion of weapon use varied more in non-Scandinavian studies.[27,54,57,63]

The percentage of weapon use (knives and firearms) was unchanged in the study period. The second Aarhus study indicated an increasing use of firearms from 1981-1982 to 1987-1988.[45] However, in the third Aarhus study from 1993-1994 the frequency was unchanged.[28] In another Scandinavian study the frequency of injuries due to knives increased in the period 1985-93.[177]

In our study we did not include the use of glass bottles and clubs in the analyses of weapon use. In Denmark glass bottles are very common. The third Aarhus study revealed an increase in the proportion of use of glasses/bottles from 6 % to 9 % in the periods 1981-1982, 1987-1988, and 1993-1994.[32] A study from England has shown similar proportions of glass and bottle use.[53]

11.2. Study 2 – Repeat contacts

11.2.1. Recurrence proportion

In our study the recurrence proportion was 22 %, and repeat victims were responsible for 44 % of all contacts due to violence in the study period. In other studies the recurrence proportion varies due to differences in study material and methodology.

In a previous A&E department study 44 % of the victims reported previous assaults within the previous five years.[57] In other A&E department studies 28-34 % of the victims reported previous assaults at least once before.[27,54] In the 1993-1994 Aarhus study the one year proportion of repeat victims was 5 %.[28] In a Norwegian one-year study 3.3 % of the patients (80/2445) visited the A&E departments more than once because of assault.[65] In a Norwegian two-year study by Steen et al. 82 % of the victims were seen only once in the A&E department.[66] Schwarz et al. showed in a US African-American population an assaultive injury recurrence proportion of 14 % in a four-year period in data from different emergency departments.[72]

Studies based on case series from US level 1 trauma centres including studies of recurrent penetrating traumas due to stabbing, gunshot, or shotgun have shown five year recurrence proportions between 32.6 % and 44 %.[73,79] Similarly, Goins et al. showed that 33 % of patients with intentional penetrating abdominal traumas had previous admissions to the hospital for assault-related injuries.[78] Additionally, Tellez et al. showed that 16 % of US hospital trauma admissions due to gunshot, stab wounds, or assaults had had previous intentional injuries requiring hospitalisation.[80] Denmark has a much lower frequency of interpersonal violence than the US. Furthermore, our study was based on data from an A&E department that treats all kinds of trauma patients from mild injuries to severe level 1 trauma patients.

The median number of A&E department and/or IFM contacts among repeat victims in our study was two. Despite differences in study length this is consistent with the results of other studies.[30,38,59,65,73,78,79]

11.2.2. Survival analysis and repeated characteristics

Survival analyses revealed that about 1/3 of the second incidents of violence occurred within the first year of the index injury. Before four years had passed, more than ¾ of the repeat victims had

experienced their second incident of violence leading to A&E department and/or IFM contact. An American retrospective study showed that in trauma centre admissions due to violence with previous incidents of violence, 94 % had suffered their previous injury within 5 years with a median length of time of 14 months.[80] Although these results are similar to our results the two studies are not comparable because of differences in study populations. In a study from New Zealand the probability of returning to the hospital because of an assaultive injury within one year was 6.3% and 6.7%, respectively, for males and females discharged after injuries due to assault.[82] Additionally, the study revealed that of those re-hospitalized, 70% had been hospitalized within 30 days of the initial hospitalisation.[82]

The characteristics of the index violence in our study with regard to place, weekday, time, lesions, and referral were similar to those in other A&E department studies. Other studies have shown similar overall patterns regarding place of violence, weekday of violence, and time of violence.[21,27,31,32,38-40,50,53,54,56,57,59-61,63-65,67,68,179] Additionally, other A&E department studies have shown similar patterns regarding types of lesions and referral following the initial treatment in the A&E department.[27,38-40,43,45,47,51,53,54,56,57,59,64,65]

The repetition percentage varied from 6 % to 76 %. For severe lesions (bone fractures and internal lesions) the repetition percentage was 28 % and 19 % for males and 23 % and 25 % for females. Additionally, of those injured by weapon(s) in the index injury 17 % of the males and 7 % of the females were also injured by weapon(s) in the next incident. Although the repetition percentage is low compared to other characteristics, it is remarkable and worrying that potentially severe lesions are repeated for about ¼ of the victims. Unfortunately, no previous A&E department or IFM study has compared the characteristics of recurrent incidents of violence.

11.3. Study 3 – Lifetime risk of violent victimization

11.3.1. The incidence rate of first time contact

Our study revealed an overall incidence rate of first time contact with an A&E department and/or an IFM of 9.2 per 1000 population/year for males and 2.6 per 1000 population/year for females. This is, as expected, slightly lower than the incidence rate of all contacts due to violence as estimated in study 1 (see section 9.1). No previous study of incidence rates is comparable to our study. Previous studies have described the incidence rates of all contacts registered at A&E departments and/or IFMs due to violence, whereas no studies have dealt exclusively with the first time contacts.

11.3.2. Lifetime risk

The present study estimated that 44 % of the males and 18 % of the females in a Danish urban population at least once in their life time on average will become victims of violence leading to contact with an A&E department or an IFM if the current incidence and mortality rates are stable.

The estimated lifetime risk in our study is comparable to only a few other studies. The majority of other studies are cross-sectional surveys with lifetime prevalence or lifetime exposure defined as the proportion of respondents exposed to violence at least once in their lifetime from birth until sampled in the study. Furthermore, differences in methodology and different definitions or cultural concepts of violence make a comparison of different studies less meaningful. In the previous study from Odense Municipality based on A&E department data from the period 1988 to 1996 the estimated lifetime risk of violence was 45 % for males and 21 % for females.[21] Although the results of this study are consistent with ours, the study was based on incidence rates of all victims attending the A&E department including victims with recurrent incidents, and no run-in period had been taken into account.

Similarly, projections of lifetime likelihood of violent victimization based on the US National Crime Survey have been made by Koppel.[86] Koppel's estimates were based on age and gender specific rates of victimization beginning at age 12 and age-specific life expectancies. The study revealed that for the total US population 89 % of the males and 73 % of the females will become victims of violent crimes. The higher likelihood rates in the American population may partly be due to higher rates of violent crime in the US and partly to differences in materials and methods. The US study was based on biannual interviews with about 101,000 persons and included all types of completed or attempted violent crimes (rapes, robbery, and assault).[86] In the same study the lifetime likelihood of assault was 82 % for males and 62 % for females, and the overall lifetime likelihood of assault or robbery leading to an injury was 40 %.[86]

Our study shows that in one half of the males and one third of the females the victimization will occur in adolescence between 15 and 24 years of age. Similar results have been found by Koppel.[86] In our study we defined lifetime risk as the cumulative risk from birth until the age of 99 years, which was the age of the oldest victim in the study. Instead we could have chosen the gender specific mean life expectancy at birth as the cut off point in the estimations. However, from the age of 60 years and onward the number of first time incidents of violence was small and the increase in the cumulative time risk from that age was very limited. If lifetime risk was defined as the cumulative risk from birth until the age of 60 years, the lifetime risk would have been 0.424 [95 % CI: 0.422-426] for males and 0.156 [95% CI: 0.155-0.158] for females. Due to the low number of

cases among the elderly the results covering the age of 60 years or more is associated with less reliability.

Numerous surveys based on A&E department populations have described lifetime prevalences of domestic or intimate partner violence. In surveys from the US or Canada lifetime prevalences were 12 % for violence against males and ranged from 34 % to 58 % for violence against females.[95-102] In similar studies from the UK or New Zealand lifetime prevalences were between 8.5 % and 22 % for violence against males and between 21 % and 44 % for violence against females.[103-106] A survey of intimate partner violence against women based on patients visiting gynaecology clinics in the five Nordic countries revealed lifetime prevalences of any physical abuse between 38 % and 66 %.[107]

Population based surveys have revealed different lifetime prevalences of violence. In Danish surveys of adults aged 18 years or more, between 34 % and 36 % of the males and between 19 % and 24 % of the females had been exposed to violence or threats of violence at least once in their life.[18,87] In a similar American survey of adults aged 18 years or more, half of the respondents reported that they had been a victim of some form of interpersonal violence at least once in their lifetime.[180] In an American study of inner-city youth aged 14 to 19 years (median age = 17 years), 73 % of the boys and 26 % of the girls had been victims of violence.[91] In other American studies the overall lifetime exposure to some sort of violence among young adults ranged from 70 % to 82 %.[92-94]

11.4. Study 4 – Demographic and socioeconomic risk factors

11.4.1. Demographic and socioeconomic risk factors

The semi-adjusted analyses of the personal model revealed that the factors strongest associated with A&E department and/or IFM contact due to violent victimization were being a pensioner, living without a partner, and a high level of lifetime unemployment. Similarly, in the semi-adjusted analyses of the family model the factors strongest associated with A&E department and/or IFM contact due to violent victimization were low annual household gross income and living without children. Conversely, being self-employed or a manager, being a skilled or unskilled worker, and being a student were most strongly negatively associated with A&E department and/or IFM contact due to violent victimization in the personal model, whereas household crowding of 25-49 m^2 per resident high and age difference to partner of five years or more were most strongly negatively associated with A&E department and/or IFM contact due to violent victimization in the family model.

Combing the personal and the family model for fully adjusted analyses revealed that living without a partner was the single most important risk factor. Most other studies have likewise shown that living alone or single marital status are important risk factors of violent victimization.[102,108,109,116,117,119-121]

Other important factors positively associated with A&E department and/or IFM contact due to violent victimization in the combined model were low annual gross income, high level of household crowding, being a pensioner, high lifetime unemployment rate, and a large age difference to partner.

Low income has been related to increased likelihood of violent victimization in other studies.[109,117] The association between household crowding or family size and violence has been shown in a few previous studies of domestic violence.[120,123] No previous A&E department study of unselected violence has shown a similar relation. The association between unemployment and violent victimization is well known from other studies.[110,116,117,125-127] However, in a previous British case-control study based on unselected A&E department contacts due to violence did not find any significant relation between unemployment or socioeconomic group and urban violence.[76] The small sample size and the fact that controls were selected among acquaintances of the victims may explain the results.

Combining the personal and the family model for fully adjusted analyses revealed that being a student was the strongest factor negatively associated with adult violent victimization. Other important negatively associated factors were being self-employed or a manager, being a skilled or unskilled worker, and high household gross income. In most previous A&E department studies victims with low socioeconomic status such as skilled or unskilled workers or students dominate.[28,38,39,53] Similarly, cross-sectional and case-control studies have also indicated the relation between low socioeconomic status and violent victimization.[116,120,124] In our study only low socioeconomic status due to being a pensioner is also associated with an increased risk of violent victimization.

In the semi-adjusted analyses of the personal model, non-European citizenship was associated with an increased risk of violent victimization. However, the association vanished in the fully adjusted analyses of the combined model. Previous Danish and international studies have indicated that foreigners are overrepresented among unselected victims attending the A&E departments.[49,65] Additionally, foreigners have been associated with more serious injuries.[32] Another study based on unselected victims attending A&E departments did not find that victims with a foreign ethnic origin are overrepresented.[53] In line with these findings, case-control and cross-sectional studies have

shown diverging associations between foreign citizenship/ethnicity and violent victimization.[84,108,109,130]

Our findings emphasize the multifaceted nature of injuries from deliberate interpersonal violence. Future studies should consider additional factors such as psychological or psychiatric disorders, somatic health, and alcohol or drug abuse analysed in a similar design. We believe that findings from this study have indicated potential risk factors which should be specifically addressed when planning future preventive strategies.

11.5. Study 5 – Comparison of A&E department and police recorded data

The simultaneous registration of violence in the A&E department and by the police confirmed previous findings. In our study 62 % the victims were registered solely in the A&E department, 15 % only by the police, and 23 % were recorded both at the A&E department and by the police, which is consistent with a previous British study.[26] In the 1993-1994 Aarhus study 59 % (1003/1710) of the victims were registered solely in the A&E department, 13 % (229/1710) only by the police, and 28 % (478/1710) were recorded by both the A&E department and the police.[29] In a Norwegian study, though, 37 % (64/175) the victims were registered solely in the A&E department, 46 % (80/175) only by the police, and 18 % (31/175) were recorded by both the A&E department and the police.[25] Differences in the study populations' reporting of violence to the police may explain the differences.

Our study showed that 87 % of all male victims and 82 % of all female victims are registered in the A&E department, and the proportions varied very little with age and the characteristics of the assault. In previous studies between 53 % and 87 % of all registered victims were registered in the A&E department.[25,26,29,181]

In our study 27 % of the victims attending the A&E department were also recorded by the police. For males and females the proportion was 26 % and 31 %, respectively. In the previously conducted Aarhus studies the overall proportion of A&E department and/or IFM registered victims of violence who were also recorded by the police increased from 16 % to 32 % in the period 1981-1982 to 1993-1994.[30,32] International studies have shown similar overall percentages between 23 % and 46 %.[23,25,27] The gender specific percentages increased from 14 % to 31 % and from 24 % to 37 % for males and females, respectively.[29,30]

12. CONCLUSIONS

The findings from this thesis support the following main conclusions:

1. Based on A&E department data and data from the IFM we found no evidence of an increase in the incidence of deliberate interpersonal violence in the Odense Municipality in the study period 1991-2002.

2. Based on A&E department data and data from the IFM we found no evidence supporting the prevailing view that injuries from deliberate interpersonal violence have become more severe in the time period 1991-2002.

3. Contact with an A&E department due to violent victimization is often followed by subsequent contacts with the same A&E department and/or an IFM due to repeat violent victimization. The overall recurrence proportion was 22 % and repeat victims were responsible for 44 % of all contacts in the twelve year study period.

4. The time span from the index contact with the A&E department to the second contact with the same A&E department and/or an IFM due to violent victimization was 1.75 years for males and 1.64 years for females. The median time span varied with age group.

5. There are some similarities between recurrent incidents of violence leading to contacts with the A&E department and/or the IFM. Potentially severe lesions occur with a repeat percentage of 19 % to 28 % in males and 23 % to 25 % in females.

6. In a Danish urban population, 44 % of the males and 18 % of the females will in the course of a lifetime need medical assistance in the A&E department and/or are subjected to a medicolegal autopsy at the IFM after violent victimization.

7. By merging data on victims of violence from the health care system and data from national longitudinal demographic and socioeconomic registers it is feasible to construct robust models for analyses of risk factors of violent victimization.

8. The most important demographic and socioeconomic factors positively associated with A&E department and/or IFM contact due to violent victimization are: not living with a partner, low

annual household gross income, high lifetime unemployment rate, high level of household crowding, and a large age difference between victim and partner.

9. Citizenship is not associated with an increased risk A&E department and/or IFM contact due to violent victimization when the analyses are adjusted for all included demographic and socioeconomic factors.

13. REFERENCES

1. Statistics Denmark. Statbank Denmark. www.statbank.dk/BEF1A. Accessed April 1, 2006.
2. Statistics Denmark. Statbank Denmark. www.statbank.dk/BEF3. Accessed April 1, 2006.
3. Statistics Denmark. Statbank Denmark. www.statbank.dk/AARD. Accessed April 1, 2006.
4. Larsen CF, Jørgensen HRI, Mikkelsen JB. [Accident victims treated at the A&E department, Odense University Hospital 1991]. Page 14. Accident Analysis Group, Odense University Hospital, Denmark 1992.
5. Larsen LB, Larsen MS, Lauritsen JM. [Accident victims treated at the A&E department, Odense University Hospital 2002]. Page 36. Accident Analysis Group, Odense University Hospital, Denmark 2003.
6. Larsen MS. [Treatment of severely injured patients]. In: Larsen LB, Larsen MS, Lauritsen JM. [Accident victims treated at the A&E department 2002]. Page 31-35. Accident Analysis Group, Odense University Hospital, Denmark 2003.
7 Nordic Medico Statistical Committee. Classification of external causes of injuries. 3 ed. Nordic Medico Statistical Committee (NOMESCO), Copenhagen, Denmark 1997.
8. Danish National Board of Health. [Classification of diseases - ICD8]. 2 ed. Danish National Board of Health, Copenhagen, Denmark 1986.
9. Danish National Board of Health. [Classification of diseases - ICD10]. 1 ed. Munksgaard, Copenhagen 1993.
10. Danish Office of Civil Registration. www.cpr.dk. Accessed April 1, 2006
11. Krug EG, Dahlberg LL, Mercy JA, Zwi AB, Lozano R. World report on violence and health. World Health Organisation, Geneva 2002.
12. World Health Organisation. Milestones of a global campaign for violence prevention. World Health Organisation, Geneva 2004.
13. Ministry of Justice. [National programme to reduce interpersonal violence]. Ministry of Justice, Copenhagen 1993.
14. Danish National Board of Health. [Contacts to the A & E departments 2002 - New figures from the National Board of Health]. 2003:17. Danish National Board of Health, Copenhagen 2003.
15. Danish National Board of Health. [The Death Register 2001 - New figures from the National Board of Health]. 2005:5. Danish National Board of Health, Copenhagen, Denmark 2005.
16. Reza A, Mercy JA, Krug E. Epidemiology of violent deaths in the world. Inj Prev 2001; 7(2):104-111.
17. Statistics Denmark. www.statbank.dk/STRAF1. Accessed April 1, 2006.
18. Helweg-Larsen K. [Violence and sexual assault]. In Kjøller M, Rasmussen NK [Danish Health and Morbidity Survey 2000] page 465-80. The National Institute of Public Health, Copenhagen 2002.
19. Vestesen B. [Assault and Violence is an everyday occurrence]. Fyens Stiftstidende 2004 May 17.
20. Christiansen J, Vestesen B. [Citizens of Odense fear violence]. Fyens Stiftstidende 2005 Nov 25.

21. Skov O, Mazanti FK, Röck ND. [Is the number of injuries following deliberate violence increasing?]. Ugeskr Laeger 1999; 161(10):1407-1409.

22. Menard S, Huizinga D. Repeat victmization in a high-risk neighbourhood sample of adolescents. Youth & Society 2001; 32(4):447-472.

23. Shepherd J, Shapland M, Scully C. Recording by the police of violent offences; an Accident and Emergency Department perspective. Med Sci Law 1989; 29(3):251-257.

24. Shepherd JP, Ali MA, Hughes AO, Levers BG. Trends in urban violence: a comparison of accident department and police records. J R Soc Med 1993; 86(2):87-88.

25. Steen K, Hunskaar S. Violence: a prospective study of police and health care registrations in an urban community in Norway. Med Sci Law 2001; 41(4):337-341.

26. Sutherland I, Sivarajasingam V, Shepherd JP. Recording of community violence by medical and police services. Inj Prev 2002; 8(3):246-247.

27. Hocking MA. Assaults in south east London. J R Soc Med 1989; 82(5):281-284.

28. Brink O. The epidemiology of violence in Denmark. J Clin Forensic Med 1998; 5(1):38-44.

29. Brink O. [Less violence but more reporting to the police]. Nordisk Tidsskrift for Kriminalvidenskab 1997.

30. Nielsen J, Grymer F, Charles AV, Hedeboe J, Jensen SE, Moller BN et al. [Accidents due to violence in Arhus over the period of a year. I. Review and extent of violence]. Ugeskr Laeger 1983; 145(50):3929-3934.

31. Schroder HM, Petersen KK, Eiskjaer SP, Charles AV. Epidemiology of violence in a Danish municipality. Changes in the incidence during the 1980s. Dan Med Bull 1992; 39(1):81-83.

32. Brink O, Villadsen I, Davidsen MT, Petersen KK, Charles AV, Sabroe S. [Decline of violence in Aarhus. Violence registered in Aarhus hospital during a period of 12 years]. Ugeskr Laeger 1996; 158(44):6277-6281.

33. Shepherd J, Sivarajasingam V. Injury research explains conflicting violence trends. Inj Prev 2005; 11(6):324-325.

34. Shepherd JP, Sivarajasingam V, Rivara FP. Using injury data for violence prevention. Government proposal is an important step towards safer communities. BMJ 2000; 321(7275):1481-1482.

35. Shepherd JP. Emergency medicine and police collaboration to prevent community violence. Ann Emerg Med 2001; 38(4):430-437.

36. Lyons RA, Lo SV, Heaven M, Littlepage BN. Injury surveillance in children - usefulness of a centralised database of accident and emergency attendances. Inj Prev 1995; 3(1):173-176.

37. McKee CM, Gleadhill DN, Watson JD. Accident and emergency attendances rates: variation among patients from different general practices. Br J Gen Pract 1990; 40(333):150-153.

38. Carlsen A, Korsgaard GM. [Violence-related injuries a prospective study]. Ugeskr Laeger 1982; 144(22):1643-1647.

39. Andersen E, Alberdi Olano FJ. [Injuries caused by violence treated at the emergency department in Esbjerg]. Ugeskr Laeger 1983; 145(1):48-50.

40. Ernst C, Sorensen L, Rock ND, Hvass I. [Violence-related cases in the emergency ward. A 5-year follow-up of registrations made in 1981 and 1986 at the Esbjerg emergency department]. Ugeskr Laeger 1994; 156(6):801-803.

41. Charles AV, Nielsen J, Grymer F, Hedeboe J, Jensen SE, Moller BN et al. [Accidents due to violence in Arhus over the period of a year. II. Violence and women]. Ugeskr Laeger 1983; 145(50):3934-3938.

42. Moller-Madsen B, Dalgaard JB, Charles AV, Grymer F, Hedeboe J, Jensen SE et al. [Accidents due to violence in Arhus over a pereiod of a year. III. Violence and alcohol]. Ugeskr Laeger 1984; 146(8):608-612.

43. Grymer F, Moller BN, Charles AV, Hedeboe J, Jensen SE, Moller-Madsen B et al. [Accidents due to violence in Arhus over a period of a year. IV. Injuries caused by violence]. Ugeskr Laeger 1984; 146(8):613-616.

44. Charles AV, Schroder HM, Petersen KK, Eiskjaer SP. [Violence and women in Arhus. Changes in the 1980's]. Ugeskr Laeger 1991; 153(4):275-278.

45. Eiskjaer SP, Schroder HM, Charles AV, Petersen KK. Epidemiology of violence in a Danish municipality. Changes in severity during the 1980s. Dan Med Bull 1992; 39(1):83-85.

46. Petersen KK, Schroder HM, Charles AV, Eiskjaer SP. [Street violence in Arhus]. Ugeskr Laeger 1991; 153(4):272-274.

47. Brink O, Vesterby A, Jensen J. Pattern of injuries due to interpersonal violence. Injury 1998; 29(9):705-709.

48. Brink O, Bitch O, Petersen KK, Charles AV. [Violence in Aarhus over two decades]. Ugeskr Laeger 2002; 164(8):1044-1048.

49. Brink O, Bitch O, Petersen KK, Charles AV. Two decades of violence. A cohort study from the Danish municipality of Aarhus. Dan Med Bull 2002; 49(1):64-67.

50. Breiting VB, Aalund O, Albrektsen SB, Danielsen L, Helweg-Larsen K, Jacobsen J et al. Injuries due to deliberate violence in areas of Denmark. I. The extent of violence. Forensic Sci Int 1989; 40(2):183-199.

51. Kjaerulff H, Jacobsen J, Aalund O, Albrektsen SB, Breiting VB, Danielsen L et al. Injuries due to deliberate violence in areas of Denmark. III. Lesions. The Copenhagen Study Group. Forensic Sci Int 1989; 41(1-2):169-180.

52. Albrektsen SB, Thomsen JL, Aalund O, Breiting VB, Danielsen L, Helweg-Larsen K et al. Injuries due to deliberate violence in areas of Denmark. IV. Alcohol intoxication in victims of violence. The Copenhagen Study Group. Forensic Sci Int 1989; 41(1-2):181-191.

53. Shepherd J, Scully C, Shapland M, Irish M, Leslie IJ. Assault: characteristics of victims attending an inner-city hospital. Injury 1988; 19(3):185-190.

54. Driscoll P, Smith J, Burdett-Smith P. A study of assault victims attending three London Accident and Emergency departments. Br J Accid Emerg Med 1988; 7:5-9.

55. Richmond PW, Evans RC. Non-accidental injury--the adult problem. Health Trends 1988; 20(3):98.

56. Fothergill NJ, Hashemi K. A prospective study of assault victims attending a suburban A&E department. Arch Emerg Med 1990; 7(3):172-177.

57. Wright J, Kariya A. Assault patients attending a Scottish accident and emergency department. J R Soc Med 1997; 90(6):322-326.

58. Howe A, Crilly M. Deprivation and violence in the community: a perspective from a UK Accident and Emergency Department. Injury 2001; 32(5):349-351.

59. Howe A, Crilly M. Violence in the community: a health service view from a UK Accident and Emergency Department. Public Health 2002; 116(1):15-21.

60. Young CA, Douglass JP. Use of, and outputs from, an assault patient questionnaire within accident and emergency departments on Merseyside. Emerg Med J 2003; 20(3):232-237.

61. Downing A, Cotterill S, Wilson R. The epidemiology of assault across the West Midlands. Emerg Med J 2003; 20(5):434-437.

62. Sivarajasingam V, Shepherd J, Matthews K, Jones S. Trends in violence in England and Wales 1995-2000: an accident and emergency perspective. J Public Health Med 2002; 24(3):219-226.

63. O'Sullivan JM, O'Conor CE. Patterns of patient presentation to a Dublin urban emergency department with assault related injuries. Ir Med J 2003; 96(10):305-307.

64. Engeland A, Kopjar B. [Injuries connected to violence--an analysis of data from the injury registry]. Tidsskr Nor Laegeforen 2000; 120(6):714-717.

65. Melhuus K, Sorensen K. [Violence 1994--Oslo Legevakt]. Tidsskr Nor Laegeforen 1997; 117(2):230-235.

66. Steen K, Hunskaar S. Medical consequences of violence: a two-year prospective study from a primary care accident and emergency department in Norway. Scand J Prim Health Care 2002; 20(2):108-112.

67. Steen K, Hunskaar S. Violence in an urban community from the perspective of an accident and emergency department: a two-year prospective study. Med Sci Monit 2004; 10(2):CR75-CR79.

68. Bostrom L. Injury panorama and medical consequences for 1158 persons assaulted in the central part of Stockholm, Sweden. Arch Orthop Trauma Surg 1997; 116(6-7):315-320.

69. Danielsson A, Blomqvist E, Bylund PO, Bjornstig U. [Injuries due violence. A study of victims attending the A & E department in Umeaa 2002]. 120. 2002. Umeaa, Sweden, Accident Analysis Group.

70. Nunez S, Garcia-Martin P, guirre-Jaime A. Victims of violence in an emergency department. Eur J Emerg Med 2000; 7(1):45-49.

71. Holmes JH, Schwarz DF, Grisso JA. Repeat injuries in an inner city population--Philadelphia, 1987-1988. MMWR Morb Mortal Wkly Rep 1990; 39(1):1-3.

72. Schwarz DF, Grisso JA, Miles CG, Holmes JH, Wishner AR, Sutton RL. A longitudinal study of injury morbidity in an African-American population. JAMA 1994; 271(10):755-760.

73. Morrissey TB, Byrd CR, Deitvh EA. The incidence of recurrent penetrating trauma in an urban trauma center. J Trauma 1991; 31(11):1536-1538.

74. Buss TF, Abdu R. Repeat victims of violence in an urban trauma center. Violence Vict 1995; 10(3):183-194.

75. Moscovitz H, Degutis L, Bruno GR, Schriver J. Emergency department patients with assault injuries: previous injury and assault convictions. Ann Emerg Med 1997; 29(6):770-775.

76. Shepherd JP, Robinson L, Levers BG. Roots of urban violence. Injury 1990; 21(3):139-141.

77. Poole GV, Griswold JA, Thaggard VK, Rhodes RS. Trauma is a recurrent disease. Surgery 1993; 113(6):608-611.

78. Goins WA, Thompson J, Simpkins C. Recurrent intentional injury. J Natl Med Assoc 1991; 84(5):431-435.

79. Sims DW, Bivins BA, Obeid FN, Horst HM, Sorensen VJ, Fath JJ. Urban trauma: a chronic recurrent disease. J Trauma 1989; 29(7):940-946.

80. Tellez MG, Mackersie RC, Morabito D, Shagoury C, Heye C. Risks, costs, and the expected complication of re-injury. Am J Surg 1995; 170(6):660-663.

81. Cooper C, Eslinger D, Nash D, al-Zawahri J, Stolley P. Repeat victims of violence: report of a large concurrent case-control study. Arch Surg 2000; 135(7):837-843.

82. Dowd MD, Langley J, Koepsell T, Soderberg R, Rivara FP. Hospitalizations for injury in New Zealand: prior injury as a risk factor for assaultive injury. Am J Public Health 1996; 86(7):929-934.

83. Litaker D. Preventing recurring injuries from violence: the risk of assault among Cleveland youth after hospitalization. Am J Public Health 1996; 86(11):1633-1636.

84. Lipsky S, Caetano R, Field CA, Bazargan S. Violence-related injury and intimate partner violence in an urban emergency department. J Trauma 2004; 57(2):352-359.

85. Ponzer S, Bergman B, Brismar B. Morbidity and injury recurrence in victims of firearm injuries. Public Health 1996; 110(1):42-46.

86. Koppel J. Lifetime likelihood of victimization. Bureau of Justice Statistics Technical Report. Bureau of Justice Statistics, Washington DC, USA 1987.

87. Christensen E, Koch-Nielsen I. [Violence outside and in the home]. Report 92:4. 1992. National Danish Institute of Social Research. Copenhagen, Denmark 1992.

88. Sundaram V, Curtis T, Helweg-Larsen K, Bjerregaard P. Can we compare violence data across countries? Int J Circumpolar Health 2004; 63 Suppl 2:389-396.

89. Curtis T, Larsen FB, Helweg-Larsen K, Bjerregaard P. Violence, sexual abuse and health in Greenland. Int J Circumpolar Health 2002; 61(2):110-122.

90. Elliot NL, Quinless FW, Parietti ES. Assessment of a Newark neighbourhood: process and outcomes. J Community Health Nurs 2000; 17(4):211-224.

91. Perez-Smith AM, Albus KE, Weist MD. Exposure to violence and neighbourhood affiliation among inner-city youth. J Clin Child Psychol 2001; 30(4):464-472.

92. Scarpa A. Community violence exposure i an young adult sample. Lifetime prevalence and socioemotional effects. J Interpers Violence 2001; 16(1):36-53.

93. Scarpa A, Fikretoglu D, Bowser F, Hurley JD, Pappert CA, Romero N et al. Community violence exposure in university Students. A replication and extension. J Interpers Violence 2002; 17(3):253-272.

94. Fitzpatrick KM, Boldizar JP. The prevalence and consequences of exposure to violence among African-American youth. J Am Acad Child Adolesc Psychiatry 1993; 32(2):424-430.

95. Zachary MJ, Mulvihill MN, Burton WB, Goldfrank LR. Domestic abuse in the emergency department: can a risk profile be defined? Acad Emerg Med 2001; 8(8):796-803.

96. Abbott J, Johnson R, Koziol-McLain J, Lowenstein SR. Domestic violence against women. Incidence and prevalence in an emergency department population. JAMA 1995; 273(22):1763-1767.

97. Gin NE, Rucker L, Frayne S, Cygan R, Hubbell FA. Prevalence of domestic violence among patients in three ambulatory care internal medicine clinics. J Gen Intern Med 1991; 6(4):317-322.

98. Cox J, Bota GW, Carter M, Bretzlaff-Michaud JA, Sahai V, Rowe BH. Domestic violence. Incidence and prevalence in a northern emergency department. Can Fam Physician 2004; 50:90-97.

99. Dearwater SR, Coben JH, Campbell JC, Nah G, Glass N, McLoughlin E et al. Prevalence of intimate partner abuse in women treated at community hospital emergency departments. JAMA 1998; 280(5):433-438.

100. Kramer A, Lorenzon D, Mueller G. Prevalence of intimate partner violence and health implications for women using emergency departments and primary care clinics. Womens Health Issues 2004; 14(1):19-29.

101. El-Bassel N, Gilbert L, Witte S, Wu E, Gaeta T, Schilling R et al. Intimate partner violence and substance abuse among minority women receiving care from an inner-city emergency department. Womens Health Issues 2003; 13(1):16-22.

102. Jones AS, Gielen AC, Campbell JC, Schollenberger J, Dienemann JA, Kub J et al. Annual and lifetime prevalence of partner abuse in a sample pf female HMO enrollees. Womens Health Issues 1999; 9:295-305.

103. Boyle A, Todd C. Incidence and prevalence of domestic violence in a UK emergency department. Emerg Med J 2003; 20(5):438-442.

104. Koziol-McLain J, Gardiner J, Batty P, Rameka M, Fyfe E, Giddings L. Prevalence of intimate partner violence among women presenting to an urban adult and paediatric emergency care department. N Z Med J 2004; 117(1206):U1174.

105. Sethi D, Watts S, Zwi A, Watson J, McCarthy C. Experience of domestic violence by women attending an inner city accident and emergency department. Emerg Med J 2004; 21(2):180-184.

106. Roberts GL, O'Toole BI, Raphael B, Lawrence JM, Ashby R. Prevalence study of domestic violence victims in an emergency department. Ann Emerg Med 1996; 27(6):741-753.

107. Wijma B, Schei B, Swahnberg K, Hilden M, Offerdal K, Pikarinen U et al. Emotional, physical, and sexual abuse in patients visiting gynaecology clinics: a Nordic cross-sectional study. Lancet 2003; 361(9375):2107-2113.

108. Allgulander C, Nilsson B. Victims of criminal homicide in Sweden: a matched case-control study of health and social risk factors among all 1,739 cases during 1978-1994. Am J Psychiatry 2000; 157(2):244-247.

109. Klein PJ, Gerberich SG, Gibson RW, Maldonado G, Kruttschnitt C, Larntz K et al. Risk factors for work-related violent victimization. Epidemiology 1997; 8(4):408-413.

110. Reed JA, Smith RS, Helmer, S.D., Lancaster BA, Carman CG. Rates of unemployment and penetrating trauma are correlated. South Med J 2003; 96(8):772-774.

111. Kyriacou DN, Hutson HR, Anglin D, Peek-Asa C, Kraus JF. The relationship between socioeconomic factors and gang violence in the City of Los Angeles. J Trauma 1999; 46(2):334-339.

112. Kaplan GA, Pamuk ER, Lynch JW, Cohen RD, Balfour JL. Inequality in come and mortality in the United States: analysis for mortality and potential pathways. BMJ 1996; 312:999-1003.

113. Kennedy BP, Kawachi I, Prothrow-Sith D. Income distribution and mortality: cross sectional ecological study of Robin Hood index in the United States. BMJ 1996; 312:1004-1007.

114. Pickett KE, Mookherjee J, Wilkinson RG. Adolescent birth rates, total homicide, and income inequality in rich countries. Am J Publ Health 2005; 95(7):1181-1183.

115. Kennedy BP, Kawachi I, Prothrow-Stith D, Lochner K, Gupta V. Social capital, income inequality, and firearm violent crime. Soc Sci Med 1998; 47(1):7-17.

116. Chalmers DJ, Fanslow JL, Langley JD. Injury from assault in New Zealand: an increasing public health problem. Aust J Public Health 1995; 19(2):149-154.

117. Grande ED, Hickling J, Taylor A, Woollacott T. Domestic violence in South Australia: a population survey of males and females. Aust N Z J Public Health 2003; 27(5):543-550.

118. Swahnberg K, Wijma B, Schei B, Hilden M, Irminger K, Wingren GB. Are sociodemographic and regional and sample factors associated with prevalence of abuse? Acta Obstet Gynecol Scand 2004; 83(3):276-288.

119. Hofner MC, Python NV, Martin E, Gervasoni JP, Graz B, Yersin B. Prevalence of victims of violence admitted to an emergency department. Emerg Med J 2005; 22(7):481-485.

120. Malcoe LH, Duran BM, Montgomery JM. Socioeconomic disparities in intimate partner violence against Native American women: a cross-sectional study. BMC Med 2004; 2(1):20.

121. McCauley J, Kern DE, Kolodner K, Dill L, Schroeder AF, DeChant HK et al. The "battering syndrome": prevalence and clinical characteristics of domestic violence in primary care internal medicine practices. Ann Intern Med 1995; 123(10):737-746.

122. Burazeri G, Roshi E, Jewkes R, Jordan S, Bjegovic V, Laaser U. Factors associated with spousal physical violence in Albania: cross sectional study. BMJ 2005; 331(7510):197-201.

123. Flake DF. Individual, family, and community risk markers for domestic violence in Peru. Violence Against Women 2005; 11(3):353-373.

124. Rivera-Rivera L, Lazcano-Ponce E, Salmeron-Castro J, Salazar-Martinez E, Castro R, Hernandez-Avila M. Prevalence and determinants of male partner violence against Mexican women: a population-based study. Salud Publica Mex 2004; 46(2):113-122.

125. Wright J, Kariya A. Aetiology of assault with respect to alcohol, unemployment and social deprivation: a Scottish accident and emergency department case-control study. Injury 1997; 28(5-6):369-372.

126. Yancey AH, Gabel-Hughes KS, Ezell S, Zalkind DL. The relationship between violent trauma and nonemployment in Washington, DC. J Natl Med Assoc 1994; 86(9):661-666.

127. Wohlfarth T, Winkel FW, Ybema JF, van den Brink W. The relationship between socioeconomic inequality and criminal victimization a prospctive study. Soc Psychiatry Psychiatr Epidemiol 2001; 36:361-370.

128. Hirschinger NB, Grisso JA, Wallace DB, McCollum KF, Schwarz DF, Sammel MD et al. A case-control study of female-to-female nonintimate violence in an urban area. Am J Public Health 2003; 93(7):1098-1103.

129. Grisso JA, Schwarz DF, Hirschinger N, Sammel M, Brensinger C, Santanna J et al. Violent injuries among women in an urban area. N Engl J Med 1999; 341(25):1899-1905.'

130. Kyriacou DN, Anglin D, Taliaferro E, Stone S, Tubb T, Linden JA et al. Risk factors for injury to women from domestic violence. N Engl J Med 1999; 341(25):1892-1898.

131. Parish WL, Wang T, Laumann EO, Pan S, Luo Y. Intimate partner violence in China: national prevalence, risk factors and associated health problems. Int Fam Plan Perspect 2004; 30(4):174-181.

132. Skog OJ, Bjork E. [Alkohol and violent crime]. Nordisk Tidsskrift for Kriminalvidenskab 1988; 75:1-23.

133. Shepherd J, Brickley M. The relationship between alcohol intoxication, stressors, and injury in urban violence. Brit J Criminol 1996; 36(4):546-566.

134. Rossow I. Alcohol-related violence: the impact of drinking pattern and drinking context. Addiction 1996; 91(11):1651-1661.

135. Cunningham R, Walton MA, Maio RF, Blow FC, Weber JE, Mirel L. Violence and substance use among an injured emergency department population. Acad Emerg Med 2003; 10(7):764-775.

136. Cherpitel CJ. Alcohol and injuries resulting from violence: a review of emergency room studies. Addiction 1994; 89(2):157-165.

137. Yates DW, Hadfield J.M, Peters K. Alcohol consumption of patients attending two accident and emergency department in north-west England. J R Soc Med 1987; 80:486-489.

138. Lauritsen JL, Laub JH, Sampson RJ. Conventional and delinquent activities: implications for the prevention of violent victimization among adolescents. Violence Vict 1992; 7(2):91-108.

139. Shepherd JP, Peak JD, Haria S, Sleeman F. Characteristic illness behaviour in assault patients: DATES syndrome. J R Soc Med 1995; 88(2):85-87.

140. Shepherd J, Farrington D, Potts J. Relations between offending, injury and illness. J R Soc Med 2002; 95(11):539-544.

141. Rivara FP, Shepherd JP, Farrington DP, Richmond PW, Cannon P. Victim as offender in youth violence. Ann Emerg Med 1995; 26(5):609-614.

142. Jacobson A, Richardson B. Assault experiences of 100 psychiatric inpatients: evidence of the need for routine inquiry. Am J Psychiatry 1987; 144(7):908-913.

143. Jacobson A. Physical and sexual assault histories among psychiatric outpatients. Am J Psychiatry 1989; 146(6):755-758.

144. Jacobson A, Herald C. The prevalence of childhood sexual abuse to adult psychiatric inpatient care. Hosp Community Psychiatry 1990; 41(2):154-158.

145. Muenzenmaier K, Meyer I, Struening E, Ferber J. Childhood abuse and neglect among women outpatients with chronic mental illness. Hosp Community Psychiatry 1993; 44(7):666-670.

146. Hiday VA, Swartz MS, Swanson JW, Borum R, Wagner HR. Criminal victimization of persons with severe mental illness. Psychiatr Serv 1999; 50(1):62-68.

147. Hiroeh U, Appleby L, Mortensen PB, Dunn G. Death by homicide, suicide, and other unnatural causes in people with mental ilness: a population-based study. Lancet 2001; 358:2110-2112.

148. Lehman AF, Linn LS. Crimes against discharged mental patients in board-and-care homes. Am J Psychiatry 1984; 141(2):271-274.

149. Lindberg G, Rastam L, Gullberg B, Eklund GA. Low serum cholesterol concentration and short term mortality from injuries in men and women. BMJ 1992; 305(6848):277-279.

150. Neaton JD, Blackburn H, Jacobs D, Kuller L, Lee DJ, Sherwin R et al. Serum cholesterol level and mortality findings for men screened in the Multiple Risk Factor Intervention Trial. Multiple Risk Factor Intervention Trial Research Group. Arch Intern Med 1992; 152(7):1490-1500.

151. Schuit AJ, Dekker JM, Schouten EG, Kok FJ. Low serum cholesterol and death due to accidents, violence, or suicide. Lancet 1993; 341(8848):827.

152. Golomb BA. Cholesterol and violence: is there a connection? Ann Intern Med 1998; 128(6):478-487.

153. Steen K, Hunskaar S. Gender and physical violence. Soc Sci Med 2004; 59(3):567-571.

154. Association for the Advancement of Automotive Medicine. The Abbreviated Injury Scale. 1990 Revision - Update 98. Association for the Advancement of Automotive Medicine, Des Plaines, IL, USA 1998.

155. Shepherd JP, Shapland M, Pearce NX, Scully C. Pattern, severity and aetiology of injuries in victims of assault. J R Soc Med 1990; 83(2):75-78.

156. Brink O. [Violence in Aarhus] Thesis. University of Aarhus, Aarhus, Denmark 1999.

157. Statistics Denmark. [IDA - Integrated Database for Labour Market Research]. www.dst.dk/TilSalg/Forskningsservice/Fsedatabaser/IDA.aspx. Accessed January 10, 2006.

158. Statistics Denmark. [The Danish Register for Health and Social Conditions. Database for research in health and social conditions]. www.dst.dk/fbregister. Accessed January 10, 2006.

159. Keiding N. Age-specific incidence and prevalence: a statistical perspective. J R Statist Soc 1991; 154:371-412.

160. Efron B, Tibsshirani R. Bootstrap measures for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical Science 1986; 1:54-77.

161. Efron B. Bootstrap methods: Another look at the jack-knife. Annals of Statistics 1979; 7:1-26.

162. Lauritsen JM, Bruus M. Epidata. www.epidata.dk. Accessed April 1, 2006.

163. Juul S. Introduction to Stata 8. Department of Epidemiology and Social Medicine, University of Aarhus, Denmark. www.folkesundhed.au.dk/uddannelse/software. Accessed January 10, 2006.

164. National Committee on Biomedical Research Ethics. Guidelines about notification etc. of a biomedical research project to the committee system on biomedical research ethics. National Committee on Biomedical Research Ethics. www.cvk.im.dk/visArtikel.asp?artikelID=1642. Accessed January 10, 2006.

165. The Danish Data Protection Agency. The Danish Act on Processing of Personal Data. The Danish Data Protection Agency. http://www.datatilsynet.dk/eng/index.html. Accessed January 10, 2006.

166. Statistics Denmark. [Access to micro data from Statistics Denmark]. www.dst.dk/HomeUK/ForSale/Research/acces.aspx. Accessed January 10, 2006.

167. Faergemann C. [Victims of violence treated in the hospitals of Funen County 1999-2003]. In: Larsen LB, Larsen MS, Lauritsen JM. [Accident victims treated at the A & E department, Odense University Hospital 2003]. Page 10-20. Accident Analysis Group, Odense University Hospital 2004.

168. Steen K, Hunskaar S. Violence in an urban community: a population-based interview study. Scand J Public Health 2000; 28(3):209-213.

169. Lauritsen JM. [Injury and facility contacts. A random population sample]. Institute for Health Economy and Health Care, University of Odense, Denmark 1987.

170. McLeer SV, Anwar R. A study of battered women presenting in an emergency department. Am J Public Health 1989; 79(1):65-66.

171. Shepherd J, Irish M, Scully C, Leslie I. Alcohol consumption among victims of violence and among comparable U.K. populations. Br J Addict 1989; 84(9):1045-1051.

172. Statistics Denmark. www.dst.dk/Vejviser/dokumentation/Varedeklarationer.aspx?sysrid=852. Accessed January 10, 2006.

173. Statistics Denmark. www.dst.dk/Vejviser/dokumentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=761. Accessed January 10, 2006.

174. Statistics Denmark. www.dst.dk/Vejviser/dokumentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=1013. Accessed January 10, 2006.

175. Statistics Denmark. www.dst.dk/Vejviser/dokumentation/Varedeklarationer/emnegruppe/emne.aspx?sysrid=98591. Accessed January 10, 2006

176. Bostrom L, Jersenius U, Boijsen M, Riddez L. [Few gunshot wounds in Stockholm. During 9 years 3 persons died because of gunshot injuries]. Lakartidningen 1994; 91(44):3981-3986.

177 Bostrom L, Jersenius U, Riddez L, Boijsen M. [Increased number of knife assaults in spite of the legislation. Record of injuries among 399 patients]. Lakartidningen 1994; 91(42):3801-3804.

178. Hougen HP, Rodge S, Poulsen K. Homicide by firearms in two Scandinavian capitals. Am J Foren Med Pathol 2000; 21(3):281-283.

179. Nielsen J, Traekjaer SE, Hedeboe, J, Moller-Madsen B, Moller BN et al. [Violence in Aarhus during one year]. Nordisk Tidsskrift for Kriminalvidenskab 1983;70(4):225-235.

180. Elliott DM. Traumatic events: Prevalence and delayed recall in the general population. J Consult Clin Psychol 1997; 65(5):811-820.

181. Brink O, Sorensen V. [Is the dark figure of violence decreasing?]. Nordisk Tidsskrift for Kriminalvidenskab 2001;230-239.

Paper I

Available online at www.sciencedirect.com
ScienceDirect
Journal of Forensic and Legal Medicine 14 (2007) 20–26
JOURNAL OF FORENSIC AND LEGAL MEDICINE
www.elsevier.com/jflm

Original communication

Trends in deliberate interpersonal violence in the Odense Municipality, Denmark 1991–2002. ☆ The Odense study on deliberate interpersonal violence

Christian Faergemann [a,*], Jens Martin Lauritsen [a,b], Ole Brink [c], Ole Skov [a]

[a] *Accident Analysis Group, Department of Orthopaedics, Odense University Hospital, DK-5000 Odense C, Denmark*
[b] *Institute of Public Health, University of Southern Denmark, Sdr. Boulevard 23A, DK-5000 Odense C, Denmark*
[c] *Department of Orthopaedics, Aarhus University Hospital, DK-8000 Aarhus C, Denmark*

Available online 10 March 2006

Abstract

A 12-year study was carried out to investigate the development of interpersonal violence based on A and E department and/or forensic data from a Danish urban population. Included in the study were all victims of violence from the Odense municipality treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1991–2002. Overall 14,316 victims of violence were included in the study. The incidence rates of violence were 9.9 and 3.4 per 1000 population/year for males and females. For males the incidence rate decreased in the study period whereas the incidence rate was unchanged among females. Less serious lesions and wounds were the most common type of lesions. The percentage of less serious lesions increased in the study period. The percentage of potential severe lesions such as bone fractures and deep lesions decreased in the study period. The percentage of patients stabbed or cut with knifes, the percentage of gunshots, and the mortality rate did not change in the study period. The present study showed no evidence of an increased frequency or severity of interpersonal violence which contrasts with the increased public concern about violence.

Keywords: Violence; Epidemiology; Severity; Trend; Injury

1. Introduction

Deliberate interpersonal violence is one of the leading causes of injury worldwide.[1] Each day the media bring violence to public attention. It appears to have become a common opinion in Denmark that the frequency of violence has increased, and that injuries have become more severe. According to a Danish survey 42% of females and 9% of males avoid empty or desolate parts of cities because of the risk of exposure to violence or sexual assault.[2]

Previous studies based on police crime statistics have shown an increasing frequency of violence.[3,4] However, papers have documented the limitations of these data sources due to high level of non-reporting.[4–7] Therefore, the use of hospital based data in violence research and prevention has been recommended.[6–9]

Numerous papers have described the frequency and severity of violence based on hospital data. The majority of these papers cover a short period of time, whereas studies showing the development in frequency and severity over decades are few. Sivarajasingam et al. found no overall significant change in levels of violence between 1995 and 2000 in an English and Welsh population.[10] A Norwegian study showed a 15–20% decrease in the annual incidence rates of

☆ The study was founded by the University of southern Denmark, the Dagmar Marshall Foundation, Østifterne Insurance Company, Grethe and Sigurd Pedersen's Foundation, and the Funen County. The authors' work was independent of the founding.
* Corresponding author. Tel.: +45 6541 2283; fax: +45 6613 6581.
E-mail address: christian.faergemann@ouh.fyns-amt.dk (C. Faergemann).

1752-928X/$ - see front matter
doi:10.1016/j.jcfm.2006.01.001

violence in the period 1990–1997.[11] A Swedish study showed an increase in the age-standardized incidence rate of hospital admissions following violence in males 1987–1994.[12] In a previous Danish study covering the study periods 1981–82, 1987–88, and 1993–94 the annual incidence rates decreased from 6.5 to 4.6 per 1000.[5]

Temporal changes in severity of violence are not well researched. Brink found no change in the severity of lesions, and the frequency of penetrating violence and the use of weapons remained unchanged in a Danish population in the periods 1981–82, 1987–88, and 1993–94.[13] Boström et al. showed an increasing frequency of stab wounds in a Swedish population during the time period 1985–1993.[14] However, more studies on the development in lesions and severity of violence are needed.

The aim of this study was to describe the development in the frequency and severity of physical deliberate interpersonal violence based on hospital and/or forensic data from a Danish urban population during the time period 1991–2002.

2. Methods

Physical deliberate interpersonal violence has previously been defined by the World Health Organisation.[1] The population base for the study was the Odense Municipality in Denmark for the period 1991–2002. All victims of violence treated at the open access accident and emergency (A and E) department at Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark were included as cases. In cases of more than one contact for the same incident, only the first contact was included. Included were only those victims who were residents of the Odense Municipality at the time of the incident of violence. The Odense Municipality is a well-defined urban geographic area with a population of 185,000 inhabitants, mainly consisting of the city of Odense. The municipality has only one A and E department located at the Odense University Hospital, and one Institute of Forensic Medicine located at the University of Southern Denmark.

From the routine patient registration system at the A and E department at Odense University Hospital the cases for this study were included prospectively and consecutively as they presented in the A and E department for treatment. The patient registration system includes self-report information coded with the NOMESCO classification for 37,000 trauma patients annually.[15] All registration is made by the trained staff. The registration of patients with injuries from violence requires that patient disclose this information as being due to an assault. Trained physicians determine the diagnoses according to the ICD system. Before 1994, the ICD8 codes were used with a maximum of three diagnoses for each patient, and from 1994 and onward the ICD10 codes are used with a maximum of five diagnoses for each patient.

The cases from the Institute of Forensic Medicine were identified by complete review of all autopsy reports carried out by the first author. For cases in compliance with the study case definition the NOMESCO classification and ICD10 coding with a maximum of five diagnoses were recorded for each patient. In Denmark, all victims who die from violence undergo a medicolegal autopsy.

For all cases information on age, gender, diagnoses, and days of hospitalisation was obtained from the patient registration system, medical records and/or from autopsy reports.

Based on mid-year population counts we estimated age and gender specific annual incidence rates in five different age groups. The development in violence severity was determined by analysing weapon use for the whole study period and by analysing ICD based diagnoses from 1994 and onwards. The latter was due to inconsistency between ICD8 and ICD10.

Non-parametric statistics with STATA 8™ was used in all statistical analyses and a p-value < 0.05 was considered as statistically significant. All incidence rates were calculated with 95% confidence intervals (95% CI). Poisson regression was used in analyses of changes in annual incidence and mortality rates in the study period. Non-parametric trend test was used in analyses of changes in body region and the type of lesion in the study period.[16] The study was approved by the National Data Protection Agency.

3. Results

In the study period 1991–2002, 14,316 victims of deliberate physical interpersonal violence from the Odense Municipality were treated at Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark. At the A and E department 14,282 patients were registered and 20 patients were registered at the Institute of Forensic Medicine. Another, 14 patients were registered at both places. Overall 10,481 (73%) were males corresponding to a male/female ratio of 2.7. The median age was 25 years (range 0–94 years) for males and 31 years (range 0–99 years) for females (Mann–Whitney, $p = 0.000$).

The overall incidence rate was 6.5 (95% CI: 6.4–6.6) per 1000 population/year and the rate decreased significantly in the study period (Poisson regression, $p = 0.01$). The development in gender specific annual incidence rates is shown in Table 1. For males the overall incidence rate was 9.9 per 1000 population/year (95% CI: 9.7–10.1) and the rate decreased significantly in the study period (Poisson regression, $p = 0.001$). For females the overall incidence rates were 3.4 (95% CI: 3.3–3.5) per 1000 population/year with no change in the study period (Poisson regression, $p = 0.588$).

Table 2 summarizes the development in the gender specific annual incidence rates according to different age groups. For both males and females the highest overall

Table 1
Gender specific annual incidence rates per 1000 population/year for victims of violence treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1991–2002

Year	Males				Females			
	N	Population	Incidence rate	95% CI	*N*	Population	Incidence rate	95% CI
1991	906	86,753	10.4	[9.8–11.1]	336	92,044	3.6	[3.3–4.1]
1992	922	87,415	10.6	[9.9–11.4]	327	92,776	3.5	[3.2–3.9]
1993	868	87,898	9.9	[9.2–10.6]	288	93,076	3.1	[2.8–3.5]
1994	1058	88,302	12.0	[11.3–12.7]	321	93,550	3.4	[3.1–3.8]
1995	815	88,601	9.2	[8.6–9.9]	307	93,925	3.3	[2.9–3.7]
1996	771	89,121	8.7	[8.1–9.3]	275	94,309	2.9	[2.6–3.3]
1997	863	89,300	9.7	[9.0–10.3]	322	94,679	3.4	[3.0–3.8]
1998	825	89,012	9.3	[8.6–9.9]	316	94,487	3.3	[3.0–3.7]
1999	828	89,169	9.3	[8.6–9.9]	368	94,400	3.9	[3.5–4.3]
2000	880	89,194	9.9	[9.2–10.5]	328	94,373	3.5	[3.1–3.9]
2001	869	89,194	9.7	[9.1–10.4]	331	94,078	3.5	[3.2–3.9]
2002	876	89,543	9.8	[9.2–10.5]	316	94,221	3.4	[3.0–3.8]
All	10,481	1,063,502	9.9	[9.7–10.1]	3835	1,125,918	3.4	[3.3–3.5]

Table 2
Gender stratified annual incidence rates per 1000 population/year in different age groups for victims treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1991–2002

Age group	Males					Females				
	N	Population	Incidence	95% CI	*p*-Value[a]	*N*	Population	Incidence	95% CI	*p*-Value[a]
0–14	694	186,020	3.7	[3.5–4.0]	0.056	331	179,003	1.9	[1.7–2.1]	0.513
15–24	4431	160,188	27.7	[26.9–28.5]	0.403	990	164,080	6.0	[5.7–6.4]	0.004↑
25–39	3607	273,113	13.2	[12.8–13.6]	0.386	1304	259,430	5.0	[4.8–5.3]	0.030↓
40–59	1565	271,060	5.8	[5.5–6.1]	0.389	914	277,107	3.3	[3.1–3.5]	0.092
60	184	273,121	1.1	[0.9–1.2]	0.169	296	246,298	1.2	[1.1–1.3]	0.778
All	10,481	1,063,502	9.9	[9.7–10.1]	0.001↓	3835	1,125,918	3.4	[3.3–3.5]	0.588

[a] *p*-values refer to Poisson regression for change in the annual incidence in the study period.

incidence rates were in the age group 15–24 years, respectively, 27.7 (95% CI: 26.9–28.5) and 6.0 (95% CI: 5.7–6.4) per 1000 population/year. There was no significant change in the incidence rates in any of the age groups for males. For females the annual incidence rate increased significantly in the age group 15–24 years (Poisson regression, $p = 0.004$) and decreased significantly in the age group 25–39 years (Poisson regression, $p = 0.030$). Fig. 1 shows the development in the annual incidence rate in the age group 15–24 years for males and females. As the age group with the highest incidence rates the age groups account 38% of the total number of cases.

In the period 1994–2002, 10,669 victims with 16,733 lesions corresponding to 1.6 lesions per victim in both

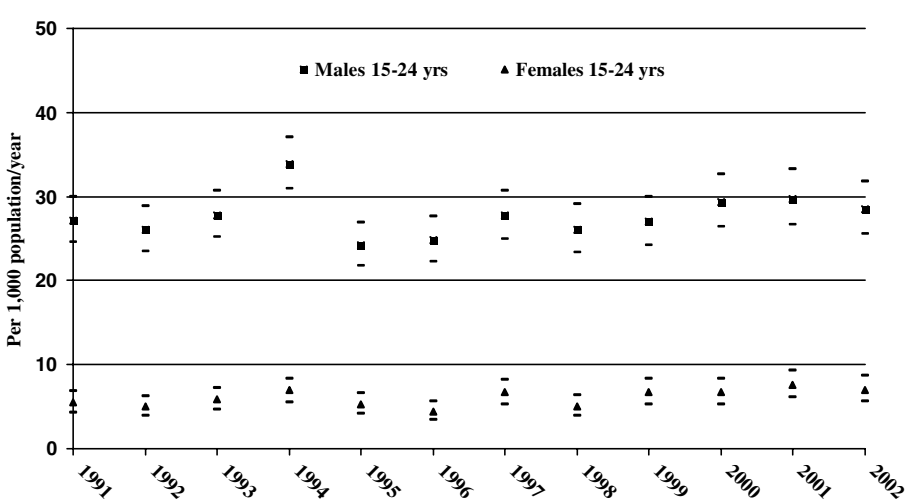


Fig. 1. Development in the annual incidence rate per 1000 population/year and 95% CI in the age group 15–24 years for males and females treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1991–2002.

males and females were registered. Table 3 shows the percentage distribution and development in body region injured according to gender 1994–2002. For both males and females the majority of the injuries were in the head or neck (63% and 49%) and the upper limbs (18% and 24%). In the study period, the percentage of injuries in the head or neck decreased significantly in the group of males (non-parametric trend test, $p = 0.01$) and increased significantly in the group of females (non-parametric trend test, $p = 0.03$). No significant trends were found in any other body region for both males and females.

Table 4 shows the percentage distribution and development in relation to type of injuries 1994–2002. For both males and females less serious injuries (abrasion or contusion) and

Table 3
The percentage distribution and development in body region for 16,733 lesions in 10,669 victims of violence treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1994–2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total	*p*-Value[a]
Males											
Head or neck	64	67	64	62	62	63	62	61	61	63	0.01↓
Thorax or abdomen	6	7	6	9	9	9	9	7	8	8	0.20
Upper limbs	19	16	18	18	19	17	19	19	19	18	0.22
Lower limbs	5	4	6	6	5	5	5	5	5	5	0.93
Other[a]	6	6	6	5	5	6	5	8	7	6	0.39
Sum	100	100	100	100	100	100	100	100	100	100	
Number	1493	1186	1108	1323	1268	1338	1419	1398	1484	12,017	
Females											
Head or neck	45	47	49	48	45	49	52	50	51	49	0.03↑
Thorax or abdomen	12	10	13	9	10	9	9	10	11	10	0.38
Upper limbs	27	27	22	25	26	25	23	27	22	24	0.27
Lower limbs	7	10	8	11	9	10	9	10	7	9	0.96
Other[a]	9	6	8	7	10	7	7	13	9	8	0.34
Sum	100	100	100	100	100	100	100	100	100	100	
Number	470	455	403	470	508	661	596	628	525	4716	

p-Values refer to non-parametric trend test for change in the percentage of each body region injured in the study period.[16]
[a] Includes poisoning, spine lesions and unspecified lesions.

Table 4
The development in relation to percentage of type of lesion for 16,733 lesions 10,669 in victims of violence treated at the Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine, University of Southern Denmark 1994–2002

	1994	1995	1996	1997	1998	1999	2000	2001	2002	Total	*p*-Value[c]
Males											
Less serious lesions	40	38	42	49	50	52	53	52	55	48	0.01↑
Wounds	31	31	31	28	26	24	27	25	24	27	0.01↓
Sprains/dislocations	4	3	5	5	4	4	4	4	4	4	0.93
Bone fractures	18	18	14	10	12	11	9	9	9	12	
Deep lesions[a]	3	4	3	3	3	3	2	2	2	3	0.01↓
Other[b]	4	6	5	5	5	6	5	8	6	6	0.02↓ 0.09
Sum	100	100	100	100	100	100	100	100	100	100	
Number	1493	1186	1108	1323	1268	1338	1419	1398	1484	12,017	
Females											
Less serious lesions	55	60	63	62	61	63	65	68	71	64	0.01↑
Wounds	14	15	14	12	15	14	13	12	10	13	0.06
Sprains/dislocations	7	7	4	8	6	3	6	5	4	6	0.12
Bone fractures	13	10	10	10	9	11	9	5	5	9	0.02↓
Deep lesions[a]	4	3	3	2	3	3	2	1	2	2	0.03↓
Other[b]	7	5	6	6	6	6	5	9	8	6	0.31
Sum	100	100	100	100	100	100	100	100	100	100	
Number	470	455	403	470	508	661	596	628	525	4716	

[a] Includes lesions in nerves, tendons, blood vessels, and internal organs.
[b] Includes burns, poisoning, foreign bodies, and unspecified lesions.
[c] *p*-Values refer to non-parametric trend test for change in the percentage of type of each lesion in the study period.[16]

wounds (penetrating all layer of the skin) were the most common type of injuries (48% and 64% vs. 27% and 13%). Respectively, 3% and 2% of the injuries in males and females were deep injuries (injury in internal organs, nerves, tendons, or blood vessels). For both males and females the percentage of less serious injuries increased in the study period (non-parametric test for trend, $p = 0.01$). In the group of males, the percentage of wounds decreased (non-parametric trend test, $p = 0.01$). The percentage of bone fractures and deep injuries decreased for both males (non-parametric trend test, $p = 0.01$ and $p = 0.02$) and females (non-parametric trend test, $p = 0.02$ and $p = 0.03$) in the study period 1994–2002.

Ninety-one percent of the males and 95% of the females were victims of blunt violence (fist, club etc.), whereas in 8% of the men and 4% of the females a sharp instrument had been used. In 1% of both males and females the violation method was unspecified. Three percent of the patients were stabbed with a knife and 0.4% had injuries due to firearms. The percentages did not change in the study period 1991–2002 (non-parametric trend test, $p = 0.91$, $p = 0.94$). Eight percent were hospitalised with at median of 3 (1–184) days the hospital. The percentage showed no change in the study period (trend test, $p = 0.25$).

Thirty-four (2.5 per 1000 victims) patients died following their injuries corresponding to mortality rate of 1.6 per 100,000 population/year. There was no change in the mortality rate in the study period (Poisson regression, $p = 0.168$). Of those who died 29% were stabbed or cut with a knife and 12% had injuries due to firearms. Those who died had 137 injuries corresponding to 4.0 injuries per victim. Fifty-six percent of the injuries were in the head/neck, 27% in the thorax/abdomen, and 17% were in the limbs or other body regions. Seven percent of the injuries were less serious (abrasion or contusion), 21% were wounds, 18% were bone fractures, 41% were deep injuries, and 13% were other types of injuries.

4. Discussion

The present study does not support an increasing frequency of deliberate interpersonal violence. Based on A and E department and forensic data we found both a slightly and significantly decreasing overall and gender specific annual incidence rate for males in a local region involving about 5% of the entire Danish population. Furthermore, we did not find any evidence that violence has become more brutal. This is in contrast to the general public opinion.

The annual incidence rates varied with age and gender. Males had a 3-fold higher overall annual incidence rate than females (9.9 vs. 3.4 per 1000 population/year). The highest annual incidence rates were in the younger population (15–24 years) for both males and females. In the study period, the annual incidence rates did not show any significant change according to different age groups for males. For females the annual incidence rate increased in the age group 15–24 years and decreased in the age group 24–39 years.

In a former study from the Odense Municipality the annual overall incidence rate declined from 8.4 to 5.7 per 1000 population/year in the period 1988–1996.[17] The present study shows that this trend has stabilized. In another Danish study from the city of Aarhus the overall annual incidence rate decreased from 6.5 to 4.6 per 1000 population/year in the period from 1981 to 2000.[5]

Data from the Norwegian Injury Sample Registry showed an average annual incidence rate of violence of 3.8 per 1000 population/year in the period 1990–1999.[11] In the same period the annual incidence rate decreased 15–20%. A prospective study from 58 A and E departments in England and Wales from 1995 to 2000 showed no significant changes in the incidence rates of violence throughout the period, except among males aged 11–17 years who experienced an increased incidence rate.[10]

The annual incidence rates, as described in our study, include only those cases requiring medical attention at the hospital or medicolegal autopsy at the Institute of Forensic Medicine. Possible selection bias arises as we have no information available about the total number of cases who seek medical attention at general practitioners or in neighbouring hospitals A previous study from the Odense Municipality has shown that about 11% of injuries, mostly of minor nature such as contusions, sprains, and simple fractures, are treated by the general practitioners.[18] Analysis of the study region (approx. radius of 45 km) has shown that only 2% of all victims of interpersonal violence from Odense municipality seek medical attention in the nearest neighbouring hospitals 45 km away.[19] Furthermore, no changes in the referral principles or organisation of treatment of injury patients in the study region have been made in the study period. Therefore, a possible selection bias affecting the development in frequency and severity is less likely.

Unfortunately, we have no information about interpersonal violence which is not registered in the health care or forensic system. Especially, our sampling methods may underestimate the incidence rates where the victim is in a dependent relationship with the perpetrator. In a Danish survey, 6% of the males and 4% of the females have been exposed to violence within the past year.[2] These percentages are in contrast to the actual number of contacts to the hospitals. However, the majority of these cases may be less severe. In an English survey 20% of the females and 8% of the males reported physical or sexual assault, or both, in the past year.[20]

We have only limited information of those victims who are recorded by the Police solely. We know from a still unpublished study that 13% of all registered victims in Odense Municipality in 2003 were solely registered by the police. In a former Danish study 15% of all registered victims of violence were solely registered in the police records

without seeking medical attention in the hospital.[21] The majority of these cases may also be less severe. However, the aspect should have more focus in further analyses. The last decades the number of police reported violence has increased steadily in Denmark due to a rise in the tendency of reporting the violence among the victims.[3]

The majority of the injuries in our study were in the head or neck and upper limbs, whereas injuries in the thorax or the abdomen accounted for less than 1/10 of the injuries. For both males and females 3/4 of the injuries were less serious injuries or wounds, whereas deeper and potentially dangerous injuries accounted for only 2–3%. Other papers have shown the same distribution of lesions according body to region and type of injuries.[11,13,22–25] We did not find any rise in the percentage of more severe injuries in the study period. On the contrary, the percentage of less serious injuries increased from 1994 to 2002 for both males and females, whereas the percentage of bone fractures and deep injuries decreased slightly. Another Danish study showed an unchanged pattern with regard to the degree of violence.[13]

The use of injuries as a tool for measuring changes in severity of violence is not optimal. However, no reliable and validated tool for severity rating of injuries due to violence exists. The abbreviated injury scale (AIS) has been used in several studies.[5,13,23,26–29] The AIS classification reflects probability of death. In these studies, 80–90% of the injuries from violence are rated as minor (AIS = 1).[13,23,26–30] Unfortunately, the AIS cannot distinguish changes within the large group of patients with minor injuries. AIS has, therefore, low sensitivity for measuring change over time.

The overall mortality rate of 1.6 per 100,000 population/year in our study is low. The overall global mortality rate of deliberate violence is 10.7 per 100,000 population/year.[30] On a national level, about 60 individuals die each year in Denmark due to deliberate interpersonal violence.[31] In Denmark, deaths from deliberate interpersonal violence less common than both deaths from suicide and accidents.[31] The mortality rate in our study is similar to mortality rates of deliberate violence in other established market economies excluding the US.[30]

Penetrating injuries due to stab/cut wounds and gunshot wounds are relatively uncommon in Scandinavia.[14,32,33] In our study 3.4% of all incidents involved lesions due to stabs or cuts with knife or gunshot in contrast to roughly half among those who died. The percentage of weapon use was unchanged in the study period. Brink showed the same unchanged pattern in another Danish urban population in the study periods 1981–82, 1987–88, and 1993–94.[13]

In a Danish survey, 42% of females and 9% of males avoid empty or desolate parts of cities because of the risk of exposure to violence or sexual assault.[2] This is in contrast to our results which indicate that males are three times more likely to become victims of violence than females. On one hand, a certain media focus upon violence may lead to this avoiding behaviour. On the other hand, the media focus upon violence and the avoiding behaviour may have lead to a reduction in the frequency of violence.

5. Conclusions

Based on A and E department and forensic data we found no evidence of an increase in the incidence of deliberate interpersonal violence in the time period 1991–2002. Furthermore, the study did find that injuries from violence have become more severe. The findings from this study are consistent with other Danish studies of violence based on A and E department and/or forensic data.

Acknowledgements

The authors acknowledge the financial support of the Institute of Clinical Research at the University of Southern Denmark, the Dagmar Marshall Foundation, Østifterne Insurance Company, Grethe and Sigurd Pedersen's Foundation, and the Funen County.

References

1. Dahlberg LL, Krug EG. Violence-global public health problem. In: Krug EG, Dahlberg LL, Mercy JA, et al., editors. *World report on violence and health*. Geneva, Switzerland: World Health Organisation; 2002. p. 3–7.
2. Larsen KH. Violence and sexual assault. In: Kjoller M, Rasmussen NK, editors. *Danish Health and Morbidity Survey 2000 and trends since 1987*. Copenhagen, Denmark: National Institute of Public Health; 2002. p. 466–79. (In Danish).
3. Brink O, Charles AV, Sabroe S, Jensen J, Sorensen V. Less violence and more police reported assaults. *Nordisk Tidsskrift Kriminalvidenskab* 1997;**84**:103–14. (In Danish).
4. Shepherd JP, Ali MA, Hughes AO, Levers BG. Trends in urban violence: a comparison of accident department and police records. *J R Soc Med* 1993;**86**:87–8.
5. Brink O, Bitch O, Petersen KK, Charles AV. Two decades of violence. A cohort study from the Danish municipality of Aarhus. *Dan Med Bull* 2002;**49**:64–7.
6. Sutherland I, Sivarajasingam V, Shepherd JP. Recording of community violence by medical and police services. *Injury Prev* 2002;**8**:246–7.
7. Ström C, Nordenram A, Johanson G. Injuries due to violent crimes: a study of police reported assaults during 1979, 1982 and 1985 in a police district of a suburb of Stockholm, Sweden. *Med Sci Law* 1991;**31**:251–8.
8. Roberts GL, O'Toole B, Lawrence J, Raphael B. Domestic violence victims in a hospital emergency department. *Med J Aust* 1993;**6**:307–10.
9. Shepherd JP, Sivarajasingam V, Rivara FP. Using injury data for violence prevention. Government proposal is an important step towards safer communities. *BMJ* 2000;**321**:1481–2.
10. Sivarajasingam V, Shepherd JP, Matthews K, Jones S. Trends in violence in England and Wales 1995–2000: an accident and emergency perspective. *J Public Health Med* 2002;**24**:219–26.
11. Engeland A, Kopjar B. Injuries from violence in Norway – analysis of the data from the Norwegian National Injury Sample Registry. *Tidsskr Nor Laegeforen* 2000;**120**:714–7. (In Norwegian).
12. Wladis A, Boström L, Nillson B. Unarmed violence-related injuries requiring hospitalization in Sweden from 1987 to 1994. *J Trauma* 1999;**47**:733–7.
13. Brink O. The epidemiology of violence in Denmark. *J Clin Forensic Med* 1998;**5**:38–44.

14. Boström L, Jersenius U, Riddez L, Boijsen M, et al. Increased number of knife assaults in spite of the legislation. Record of injuries among 399 patients. *Läkartidningen* 1994;**91**:3801–4. (In Swedish).
15. Nordic Medico Statistical Committee. NOMESCO classification of external causes of injuries. 3rd revised ed. Copenhagen, Denmark: NOMESCO; 1997.
16. Sasieni P. Stratified test for trend across ordered groups. *Stata Tech Bull* 1996;**33**:24–7.
17. Skov O, Mazanti FK, Röck ND. The incidence of hospital-treated injuries related to violence in the city of Odense 1988–1996. *Ugeskr Laeger* 1999;**161**:1407–9. (In Danish).
18. Lauritsen J. *Injury and facility contacts. A random population sample*. Report No 9. Institute for Health Economy and Health Care. Odense, Denmark: University of Odense 1987. (In Danish).
19. Faergemann C. Victims of violence treated in the hospitals of Funen County 1999–2003. In: Larsen LB, Larsen MS, Lauritsen JM, editors. *Accident victims treated at the A and E department, Odense University Hospital 2003*. Odense, Denmark: Accident Analysis Group, Odense University Hospital; 2004. p. 10–20. (In Danish).
20. Mezey G, King M, MacClintock T. Victims of violence and the general practitioner. *Br J Gen Pract* 1998;**48**:906–8.
21. Brink O, Sorensen V. Is the dark figure of violence decreasing? *Nordisk Tidsskrift Kriminalvidenskab* 2001;**88**:230–9. (In Danish).
22. Brink O, Charles AV, Jensen J. Pattern of injuries due to interpersonal violence. *Injury* 1998;**29**:705–9.
23. Kjaerulff H, Jacobsen J, Aalund O, et al. Injuries due to deliberate violence in areas of Denmark. III. Lesions. *Forensic Sci Int* 1989;**41**:169–80.
24. Shepherd JP, Shapland M, Pearce NX, Scully C. Pattern, severity and aetiology of injuries in victims of assault. *J R Soc Med* 1990;**83**:75–8.
25. Wright J, Kariya A. Assault patients attending a Scottish accident and emergency department. *J R Soc Med* 1997;**90**:322–6.
26. Boström L. Injury panorama and medical consequences for 1158 persons assaulted in the central part of Stockholm, Sweden. *Arch Orthop Trauma Surg* 1997;**116**:315–20.
27. Eiskjaer SP, Schroder HM, Charles AV, Petersen KK. Epidemiology of violence in a Danish municipality. Changes in severity during the 1980s. *Dan Med Bull* 1992;**39**:83–5.
28. Grymer F, Moller BN, Charles AV, et al. Accidents due to violence in Aarhus during a period of one year. IV. Lesions caused by violence. *Ugeskr Laeger* 1984;**146**:613–6. (In Danish).
29. Steen K, Hunskaar S. Medical consequences of violence: a two-year prospective study from a primary care accident and emergency department in Norway. *Scand J Prim Health Care* 2002;**20**:108–12.
30. Reza A, Mercy JA, Krug E. Epidemiology of violent deaths in the World. *Injury Prev* 2001;**7**:104–11.
31. National Board of Health. *New figures from the National Board of Health. Mortality 2000*. Copenhagen, Denmark: National Board of Health; 2004. p. 1–8. (In Danish).
32. Boström L, Jersenius U, Boijsen M, Riddez L. Few gunshot wounds in Stockholm. During 9 years 3 persons died because of gunshot injuries. *Läkartidningen* 1994;**91**:3981–6. (In Swedish).
33. Hougen HP, Rogde S, Poulsen K. Homicide by firearms in two Scandinavian capitals. *Am J Forensic Med Pathol* 2000;**21**:281–6.

Paper II

ARTICLE IN PRESS

Available online at www.sciencedirect.com

ScienceDirect

Journal of Forensic and Legal Medicine xxx (2007) xxx–xxx

JOURNAL OF FORENSIC AND LEGAL MEDICINE

www.elsevier.com/jflm

Original communication

The epidemiology of repeat contacts with an Emergency Department or an Institute of Forensic Medicine due to violent victimization in a Danish urban population

Christian Faergemann (PhD Student) [a,*], Jens M. Lauritsen (Assistant Professor) [a,b], Ole Brink (Assistant Professor) [c], Henrik Stovring (Assistant Professor) [d]

[a] *Accident Analysis Group, Department of Orthopaedics, Odense University Hospital, Sdr. Boulevard 29, 5000 Odense C, Denmark*
[b] *Institute of Public Health, University of Southern Denmark, J.B. Winslows Vej 9A, 5000 Odense C, Denmark*
[c] *Department of Orthopaedics, Aarhus University Hospital, Norrebrogade 44, 8000 Aarhus C, Denmark*
[d] *Research Unit for General Practice, University of Southern Denmark, J.B. Winslows Vej 9A, 5000 Odense C, Denmark*

Received 20 June 2006; received in revised form 15 October 2006; accepted 30 October 2006

Abstract

Objective: The aim of this study was to describe the epidemiology of repeat contacts with an urban emergency department (ED) and/or an institute of forensic medicine.
Methods: All victims of violence in contact with the ED at Odense University Hospital and/or the Institute of Forensic Medicine, University of Southern Denmark 1991–2002 were included. Victims who had two or more contacts were identified as repeat victims and a recurrence proportion was estimated. Survival analysis was made with time of observation from the first to the second contact due to violence and a repetition percentage was estimated as the proportion with repeated characteristics in the incident leading to the second contact compared to the index contact and a repetition percentage was estimated.
Results: Overall 10,216 individuals with 14,307 incidents were included in the study. Overall, the recurrence proportion was 22% and repeat victims who were responsible for 44% of all contacts to the ED and/or the Institute of Forensic Medicine in the study period. The median time from first to the next incident was 1.75 years for males and 1.64 years for females. Overall 34% of the males and 37% of the females experienced the next incident within 1 year. The time span decreased significantly with increasing age for both males and females. The frequency of weapon use was low with a repetition percentage of 17% for males and 7% for females. For potential severe lesions such as bone fractures and internal lesions the repetition percentage was 28% and 19% for males and 23% and 25% for females.
Conclusions: The present study showed that contact with an ED due to violent victimization often is followed by subsequent contacts with the same ED and/or the IFM due re-victimization and that recurrent incidents share characteristics.

Keywords: Violence; Epidemiology; Injuries; Recurrence

1. Introduction

Repeat contacts with emergency departments (EDs) due to violent victimization are a phenomenon well known by those who work in hospital EDs. According to the US Centers for Disease Control repeat injuries account for 10% of all visits to EDs for injuries and 27.7% of these are caused by interpersonal violence.[4] Goins et al. indicated that repeated violence-related trauma constitutes 45% of all trauma admissions caused by violence.[8] Sims et al. showed that the 5-year recurrence proportion of violence registered in US level 1 trauma centres was 44% with a mean number

* Corresponding author. Tel.: +45 6541 2283.
E-mail address: christian.faergemann@ouh.fyns-amt.dk (C. Faergemann).

1353-1131/$ - see front matter
doi:10.1016/j.jcfm.2006.10.009

of 2.6 incidents per victim.[17] Another American study showed a 32.6% recurrence proportion of penetrating trauma due to stab, gunshot or shotgun in a 5-year follow-up.[13] According to the 1992 British Crime Survey 32% of victims of assault in and around work and 39% of victims of pub fights were victimized more than once within 1 year.[11] Schwarz et al. found that those who died from intentional injury were more likely to have had a previous intentional injury, and the likelihood of future injury increased with the number of past traumas.[15]

From an epidemiological point of view the phenomenon of repeat violent victimization is difficult to deal with. First of all we need a long time span to identify the repeat victims. Secondly, we must take a run-in period into account to decide whether a given occurrence in the study period is the overall first or whether an earlier incident has occurred prior to the study period. Unfortunately, these criteria were not sufficiently met in any previously published studies based ED data. A precise description of the epidemiology of repeat contacts to an ED and/or an Institute of Forensic Medicine (IFM) including a description of the extent of repeat contacts and the assessment of the degree of similarity between recurrent contacts has implications for the planning of preventive strategies. Therefore, the aim of this study was to estimate the epidemiology of repeat contacts with an urban ED and/or IFM.

2. Materials and methods

Physical deliberate interpersonal violence was defined according to criteria of the World Health Organisation.[9] The population base for the study was the Odense Municipality in Denmark in the period 1991–2002. All victims of violence treated at the open access ED at Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine (IFM), University of Southern Denmark were included as cases. In case of more than one contact for the same incident only the first contact was included. The Odense Municipality is a geographically well-defined urban area with a population of 185,000 inhabitants, mainly consisting of the City of Odense. The municipality has only one ED, the one at Odense University Hospital, and one IFM, the one at the University of Southern Denmark. The IFM covers both Odense Municipality as well as the entire southern part of Denmark. In Denmark all unexpected deaths are subject to a detailed medicolegal autopsy at the IFMs. Annually, about 200 medicolegal autopsies are carried out at the IFM at University of Southern Denmark and approximately 10 of these are victims of deliberate interpersonal violence.

The cases for the study were included prospectively and consecutively as they presented themselves at the ED for treatment. Data on these cases were extracted from the patient registration system. The system includes self-reported information coded with the NOMESCO classification.[14] Trained staff carries out all registration of 37,000 trauma patients that are treated at the ED annually. The cases from the IFM were identified by a complete review of all autopsy reports carried out by the first author. For all cases that were in compliance with the study case definition information on age, sex, and incident of violence was obtained from the patient registration system, medical records and/or autopsy reports.

In Denmark all registered inhabitants have a unique civil registry number (cpr-number), which follows each individual for his/her entire life. In the study we defined an individual as a person with a cpr-number. The cpr-number was used to identify individuals with recurrent contacts with the ED and/or the IFM. A 5-year run-in period from 1986 to 1990 was defined after analysis of the proportion of individuals victimized in the study period 1991–2002 who were also recorded as victims in the ED register 1980–1990. The first contact due to violence in each individual was defined as the index contact taking the run-in period into account. All individuals who were both victims in the study period 1991–2002 and in the run-in period 1986–1990 were excluded from the study. An individual who had two or more contacts due to violence in the study period were defined as a repeat victim.

3. Statistical methods

Non-parametric statistics with STATA 8™ was used for basic statistical analyses and a p-value < 0.05 was considered as statistically significant. Overall and gender specific recurrent proportions were estimated as the proportions of individuals with more than one contact with the ED and/or the IFM due of violence in the study period.

The victims' registered civil addresses in the study period were extracted from the Danish Central Office of Civil Registration. The age of the victims were allocated into different age groups which referred to the age at the time of index contact. Kaplan–Meier survival analysis was made with time of observation from index contact to the first date of: second contact due to violence, moving away from Odense Municipality, death, or December 31, 2002. Failure was defined as second contact due to violence. Prior to the study we estimated the proportion of victims from the study period identified in different length of run-in period. A longer run-in period revealed only a few misclassified non-repeat victims and index contacts.

A repetition percentage was estimated as the proportion with repeated characteristics in the incident leading to the second contact compared to the incident leading to the index contact. Fisher's exact test was used to determine statistical similarity between the incidents leading to the index and the second contact due to violence. The most severe lesion leading to the index contact was compared to the most severe lesion leading to the second contact. The study was approved by the National Data Protection Agency. As the study was a register-based study no approval from the Biomedical Research Ethics Committee was needed.

Please cite this article in press as: Faergemann C et al. J Clin Forensic Med (2007), doi:10.1016/j.jcfm.2006.10.009

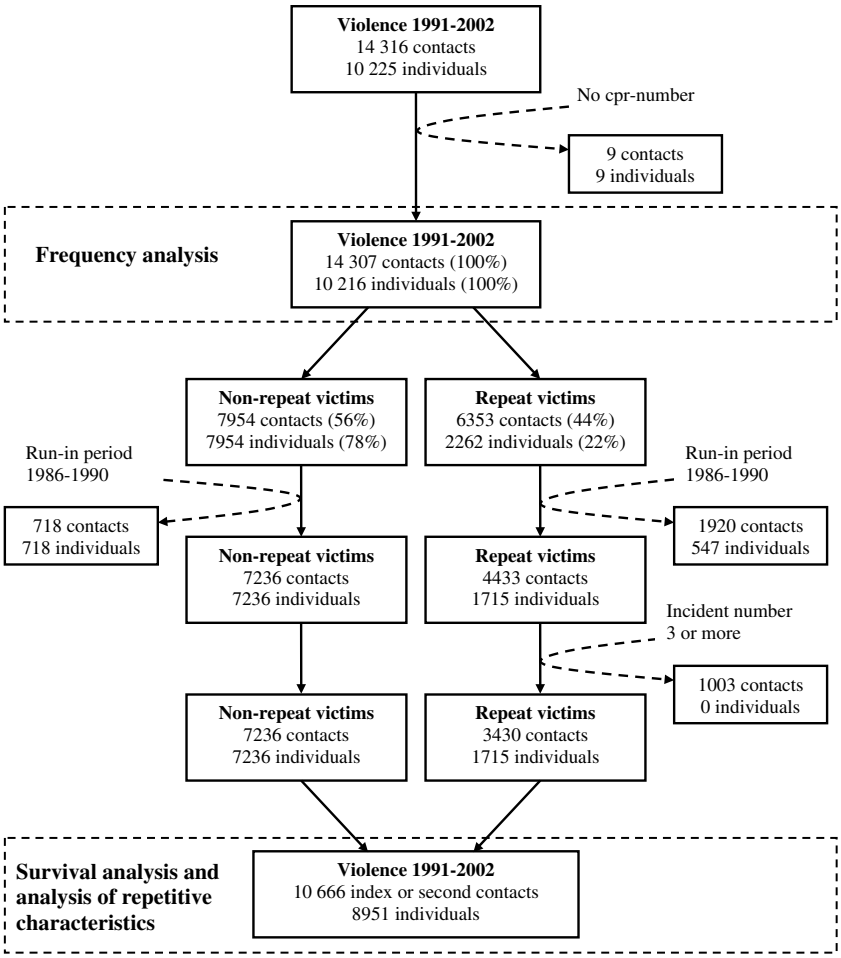


Fig. 1. The inclusion and exclusion of individuals and contacts.

4. Study population

Fig. 1 summarizes the inclusion and exclusion of individuals and contacts for the study. In the study period 14,316 contacts due to violent victimization involving 10,225 different individuals met the inclusion criteria. Nine individuals and their nine contacts were excluded as they did not have a cpr-number at the time of contact with the ED and/or the IFM. Those victims were immigrants who had not yet been assigned a cpr-number. This leaves 10,216 individuals and their 14,307 contacts for frequency analysis of repeat contacts. Then 1265 individuals and their 2638 incidents were excluded due to contacts in run-in period. Finally, all incidents number 3 or more were excluded leaving 8951 individuals with their 10,666 contacts for survival analysis and analysis of repetitive characteristics between index and second contact.

5. Results

In the 12-year study period 14,307 incidents involving 10,216 different individuals were included for frequency analysis. Among repeat victims 77% were males and 23% were females compared to 71% males and 29% females among non-repeat victims (Mann–Whitney, $p < 0.001$). For males the median age was 22 years (5–68 years) for repeat victims at the time of index contact and 24 years (range 0–94 years) for non-repeat victims (Mann–Whitney, $p < 0.001$). For females the median age was 29 years (range 4–94 years) for repeat victims at the time of index contact and 30 years (range 0–99 years) for non-repeat victims (Mann–Whitney, $p = 0.005$).

Overall 22% of the individuals were repeat victims who were responsible for 44% of all contacts to the ED and/or the IFM in the study period. For males and females 24% and 18% of the individuals were repeat victims who were responsible for 46% and 39% of all contacts. Table 1 shows the number of contacts with the ED and/or the IFM due to violent victimization stratified by gender. For those individuals with repeat contacts the median number of contacts due to violence in the study period was two for both males (range 2–15) and females (range 2–12). Thirty-four individuals died from violence in the study period. Of those who died, 27 (14 males and 13 females) died following the incident leading to the first contact and 7 died (4 males and 3 females) following the incident leading to the second contact in the study period.

Please cite this article in press as: Faergemann C et al. J Clin Forensic Med (2007), doi:10.1016/j.jcfm.2006.10.009

Table 1
The distribution of individuals according to the number of contacts with the ED and/or the IFM due to violent victimization stratified by gender

	Males	Females	All
One contact	5619 (53.7%)	2335 (60.9%)	7954 (55.6)
Two contacts	2227 (21.3%)	645 (16.8%)	2872 (20.1)
Three contacts	1039 (9.9%)	323 (8.4%)	1362 (9.5)
Four contacts	525 (5.0%)	159 (4.2%)	684 (4.8)
Five contacts	234 (2.2%)	141 (3.7%)	375 (2.6%)
Six contacts or more	830 (7.9)	230 (6.0)	1060 (7.4)
All	10,474 (100.0%)	3833 (100.0%)	14,307 (100.0%)

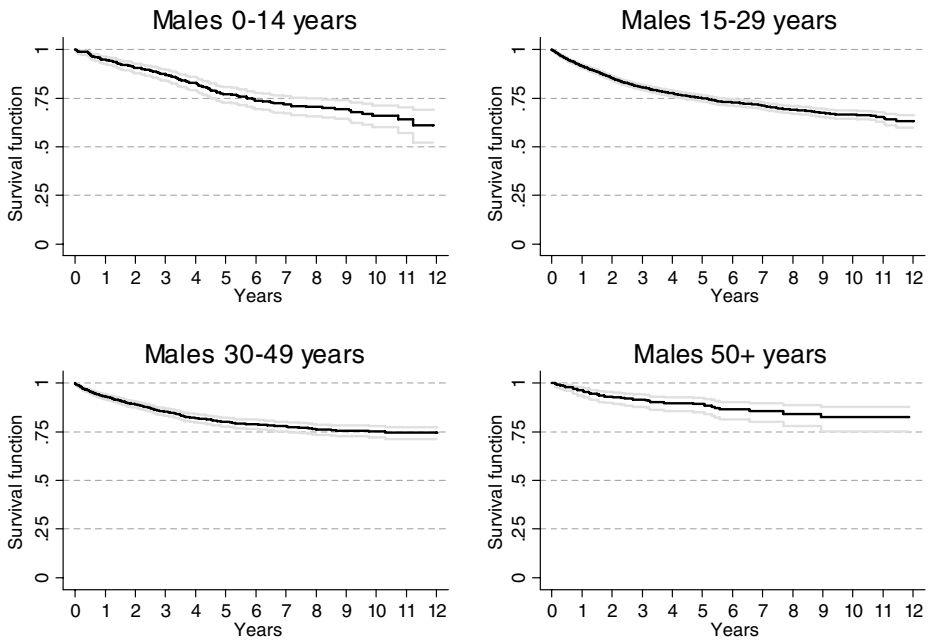


Fig. 2. Survival curves of the time span from index contact to the next contact due to violence for males stratified into different age groups including 95% CI (Kaplan–Meier).

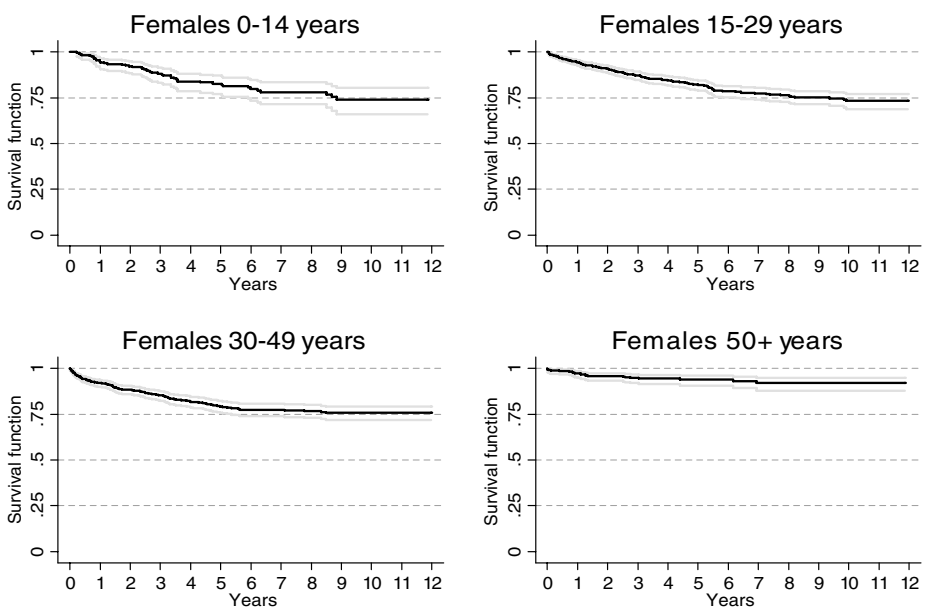


Fig. 3. Survival curves of the time span from index contact to the next contact due to violence for females stratified into different age groups including 95% CI (Kaplan–Meier).

Please cite this article in press as: Faergemann C et al. J Clin Forensic Med (2007), doi:10.1016/j.jcfm.2006.10.009

Figs. 2 and 3 shows the survival curves of the time span from index contact to the next contact due to violence for males and females stratified into different age groups. The median time span from index to the second contact was 1.75 years (range 0–11.44 years) for males and 1.64 years (range 1.00–9.91) for females (Mann–Whitney, $p = 0.385$). Overall 52 (4%) males and 26 (7%) females experienced the second contact within 4 weeks, and 452 (34%) males and 146 (37%) females within 1 year. Within 4 years 79% of both males and females had experienced the next contact. For both males and females the median time span from index to the second contact decreased significantly with increasing age group. In the age groups 0–14, 15–29, 30–49, and 50-years the median time span was 2.85, 1.69, 1.62, and 1.53 years, respectively for males (Kruskal–Wallis, $p < 0.001$), and 2.46, 2.03, 1.34, and 1.11 years, respectively for females (Kruskal–Wallis, $p = 0.005$).

Table 2 summarizes the characteristics of the incidents of violence and the injuries leading to the index contacts and the repetition percentages in the incidents leading to the second contacts stratified by gender. For males and females index violence most frequently occurred in respectively public outdoor area and domestic area with a high repetition percentage (47% vs. 76%) (Fisher's exact, $p < 0.001$ and $p < 0.001$). A high repetition percentage was seen among males for violence occurring in the weekends and in the night time, respectively 72% and 59 % (Fisher's exact, $p < 0.001$ and $p < 0.001$), and among females for violence occurring in the weekends and in the evenings, respectively 56% and 50% (Fisher's, $p = 0.101$ and $p = 0.017$). For both males and females a minor part of index violence occurred with use of weapons. The repetition percentage for weapon use was 17% for males (Fisher's exact, $p = 0.006$) and 7% for females (Fisher's exact, $p = 0.323$).

In the majority of the index violence incidents the most severe lesion was a less serious lesions (abrasions or contusions), whereas internal lesions (internal organs, tendons, nerves or blood vessels) were relatively uncommon. Potentially severe lesions such as bone fractures and internal lesions occurred with a repetition percentage of 28% and 19% for males (Fisher's exact, $p = 0.006$ and $p = 0.189$), and 23% and 25% for females (Fisher's exact, $p = 0.041$

Table 2
The characteristics of the incidents of violence and injuries leading to the index contacts and the repetition percentage in the incidents leading to the second contacts stratified by gender

	Males			Females		
	Index (*n*)	Repetition percentage (95% CI)	Fisher's exact test	Index (*n*)	Repetition percentage (95% CI)	Fisher's exact test
Place of violence						
Public outdoor area	545	47 (41–53)	$P < 0.001$	75	39 (26–56)	$P < 0.001$
Domestic area	298	39 (33–45)	$P < 0.001$	248	76 (70–81)	$P < 0.001$
Recreational area	257	39 (31–47)	$P < 0.001$	23	13 (3–38)	$P = 0.128$
Other	219	23 (17–30)	$P < 0.001$	50	40 (24–67)	$P < 0.001$
Weekday						
Monday–Thursday	469	39 (33–45)	$P < 0.001$	189	51 (42–63)	$P = 0.072$
Friday–Sunday	840	72 (67–78)	$P < 0.001$	205	56 (46–67)	$P = 0.101$
Time of violence						
08.00–15.59	186	19 (14–27)	$P < 0.001$	72	26 (16–41)	$P = 0.037$
16.00–23.59	445	42 (36–49)	$P < 0.001$	189	50 (41–62)	$P = 0.017$
24.00–07.59	536	59 (53–66)	$P < 0.001$	88	32 (21–46)	$P = 0.004$
Weapon use						
Firearm, knife or club	87	17 (7–28)	$P = 0.006$	15	7 (2–37)	$P = 0.323$
No weapon	1232	92 (87–97)	$P = 0.006$	381	98 (88–108)	$P = 0.323$
Most severe lesion						
Less severe lesion	494	42 (36–48)	$P < 0.001$	228	61 (51–71)	$P = 0.003$
Wound	406	41 (35–48)	$P < 0.001$	56	25 (14–42)	$P = 0.014$
Sprain/dislocation	75	40 (27–57)	$P = 0.622$	32	28 (13–53)	$P = 0.233$
Bone fracture	251	28 (22–35)	$P = 0.006$	40	23 (10–43)	$P = 0.041$
Internal lesion[a]	27	19 (6–43)	$P = 0.189$	8	25 (3–90)	$P = 0.702$
Other	66	6 (2–16)	$P = 0.556$	32	9 (2–27)	$P = 0.575$
Referral						
No referral	623	52 (46–58)	$P < 0.001$	255	65 (55–75)	$P = 0.265$
General practitioner	363	32 (26–38)	$P = 0.001$	57	19 (10–35)	$P = 0.158$
Outpatient clinic	257	24 (19–31)	$P = 0.022$	68	19 (10–33)	$P = 0.121$
Hospitalised	76	15 (7–26)	$P = 0.033$	16	19 (4–55)	$P = 0.121$

[a] Internal organs, nerves, blood vessels or tendons.

Please cite this article in press as: Faergemann C et al. J Clin Forensic Med (2007), doi:10.1016/j.jcfm.2006.10.009

and $p = 0.702$). Most male and female victims were treated in the ED with no further referral following the index violence. Of those hospitalised following the index violence 15% of the males and 19% of the females were also hospitalised following the next incident of violence (Fisher's exact, $p = 0.033$ and $p = 0.121$).

6. Discussion

The present study shows that contact with an ED due to violent victimization often is followed by subsequent contacts to the ED and/or the IFM due re-victimization. The overall recurrence proportion was 22% and repeat victims were responsible for 44% of all contacts to the ED and/or the IFM in the 12-year study period. Secondly, the study shows that about 1/3 of the repeat victims experienced the second contacts to the ED and/or the IFM within 1 year. Finally, the study indicates that there are some similarities between the incidents of violence leading to the index and the second contact.

For the sampling of a valid study population data we first employed the unique Danish civil registration system to separate individuals with only one contact due to violence from individuals with recurrent contacts. Secondly, the observation period was long and a run-in period was taken into account to verify whether an earlier incident leading to ED contact had occurred prior to the study period. Thirdly, we had access to precise and reliable information about the home address for each individual in the entire study period which made survival analyses possible.

Victims of violence seeking medical attention at the general practitioners, at neighbouring hospitals, or not at all were not included in the study. Therefore, results only refer to the phenomenon of repeat victimization from an ED and IFM perspective. A previous study from Odense Municipality has shown that about 11% of all injuries, mostly of a minor nature, are treated by the general practitioners.[10] An analysis of data from the same study region (approx. radius of 45 km) has shown that only 2% of all victims of violence from Odense Municipality seek medical attention at the neighbouring hospitals 45 km away.[7] Unfortunately, we have limited information about violence,which has not been registered in the health care or forensic medical systems. Preliminary results indicate that 13% of all registered victims of violence in the Odense Municipality are solely registered by the police and have had no contact with the health care or forensic medical systems (Faergemann unpublished). In another Danish study 15% of all registered victims of violence were solely registered in the police records without seeking medical attention in any hospital.[2]

When identifying the repeat victims and non-repeat victims for analysis of recurrent contacts and defining the index contacts a run-in period from 1986 to 1990 was taken into account. Selection bias may arise as victims identified as non-repeat victims may have had an earlier contact with the ED prior to the run-in period, and contacts defined as index contact, may not be the first contact. The estimation of the optimal length of run-in period prior to the study revealed only a few misclassified non-repeat victims and index contact if the run-in period was expanded.

Other studies have shown different recurrence proportions, but have not compared repetitive characteristics. Studies based on case series from US level 1 trauma centres have shown higher recurrence proportions than in our study.[8,13,17,19] Sims et al. showed a 5-year assaultive recurrence proportion of 44% in an urban population with a mean number of 2.6 assaultive incidents per repeat victim.[17] Morrissey et al. revealed a recurrence proportion of 32.6% for penetrating trauma due to stab, gunshot or shotgun alone in a 5-year follow-up with a mean number of two assaultive incidents per repeat victim.[13] Similarly, Goins et al. showed that 33% of patients with intentional penetrating abdominal trauma had previous admissions to the hospital for assault related injuries.[8] Tellez et al. showed that 16% of hospital trauma admissions due to gunshot, stab wounds or assault had previous intentional injury requiring hospitalisation.[19] The higher recurrence proportions in these studies may be due to the selection of victims in a level 1 trauma centre. Our study was based on data from an ED that treats all kinds of trauma patients from mild injuries to severe level 1 trauma patients.

Only one population based study has been conducted.[15] Schwarz et al. showed in a US African–American population an assaultive injury recurrence proportion of 14% in a 4-year period from different EDs.[15] This level is comparable to the current level at observation length of 4 years.

Survival analyses revealed that about 1/3 of the second incidents of violence occurred within the first year after the index injury. Before 4 years more than 3/4 of both males and females had experienced the second incident of violence. An American study showed that in trauma centre admissions due to violence with previous incidents of violence, 94% had suffered their previous injury within 5 years with a median length of time of 14 months.[19] Although, these results are similar to our results, the two studies are not comparable according to study population. In a study from New Zealand the probability of returning for an assaultive injury hospitalisation within 1 year for males and females previously assaulted was 6.3% and 6.7%.[5] Additionally, the study revealed, that of those hospitalized, 70% of the victims of violence were subsequently hospitalized within 30 days of the initial hospitalisation.[5]

The age and gender distribution, and the characteristics of the index violence in our study according to place, weekday, time, lesions and referral were similar to those in other studies of interpersonal violence.[1,5,6,12,16,18] The repetition percentage varied from 6% to 76%. For more severe lesions (bone fractures and internal lesions) the repetition percentage was 28% and 19% for males and 23% and 25% for females. Additionally, of those injured due to use of weapon in the index injury 17% of the males and 7% of

the females were also injured due to weapon use in the next incident. Although, the repetition percentage is low compared to other characteristics, it is remarkable and worrying that potential severe lesions are repeated for about 1/4 of the victims.

The current study underlines re-victimization as an important issue in the evaluation and assessment of hospital contacts after violent incidents. In the planning of preventive efforts this knowledge should be specifically addressed and in attempts to measure effects of strategies the repetition patterns should be taken into consideration. Especially, the relative high level of repetitious potentially severe lesions should hold an important position. The difficult question is how to address the issue. The diverse time pattern where subsequent episodes occur over many months after the first one indicates that several mechanisms are in play. Future studies should attempt to assess whether certain subgroups can be identified, so that specific effective intervention at the personal or environmental level can be implemented.

7. Conclusions

The present study showed that contact with an ED due to violent victimization often is followed by subsequent contacts with the same ED and/or the IFM due re-victimization. The overall recurrence proportion was 22% and repeat victims were responsible for 44% of all contacts in the 12-year study period. Secondly, the study showed that about 1/3 of the repeat victims experienced the second to the ED and/or the IFM within 1 year with a median time span from 1 to 3 years depending on age group. Finally, the study indicates that there are some similarities between the recurrent incidents of violence leading to ED and/or the IFM contacts.

Acknowledgements

This study was made possible by grants from the Institute of Clinical Research at the University of Southern Denmark, the Dagmar Marshall Foundation, Østifterne Insurance Company, Grethe and Sigurd Pedersen's Foundation, and the Funen County. The authors work was independent of the funding sources.

References

1. Brink O. The epidemiology of violence in Denmark. *J Clin Forensic Med* 1998;**5**:38–44.
2. Brink O, Sorensen V. Is the dark figure of violence decreasing? *Nordisk Tidsskrift for Kriminalvidenskab* 2001;**88**:230–9 [In Danish].
4. Holmes JH, Schwarz DF, Grisso JA. Repeat injuries in a inner-city population – Philadelphia,1987–1988. *Morbidity and Mortality Weekly Rep* 1990;**39**:1–3.
5. Dowd MD, Langley J, Koepsell T, Soderberg R, Rivara FP. Hospitalizations for injury in New Zealand: prior injury as a risk factor for assaultive injury. *Am J Public Health* 1996;**86**:929–34.
6. Engeland A, Kopjar B. Injuries from violence in Norway – analysis of the data from the Norwegian National Injury Sample Registry. *Tidsskrift Norske Laegeforeningen* 2000;**120**:714–7 In Norwegian.
7. Faergemann C. Victims of violence treated in the hospitals of Funen County 1999–2003. In: Larsen LB, Larsen MS, Lauritsen JM, editors. *Accident victims treated at the ED, Odense University Hospital 2003*. Odense, Denmark: Accident Analysis Group, Odense University Hospital; 2004. p. 10–20 in Danish.
8. Goins WA, Thompson J, Simpkins C. Recurrence intentional injury. *J Nat Med Assoc* 1992;**84**:431–45.
9. Dahlberg LL, Krug EG, Mercy JA. Violence – a global public health problem. In: Krug EG, Dahlberg LL, Mercy JA, editors. *World report on violence and health*. Geneva, Switzerland: World Health Organisation; 2002. p. 3–7.
10. Lauritsen J, Injury and facility contacts. A random population sample. Report No 9. Institute for Health Economy and Health Care. Odense, Denmark: University of Odense; 1987 in Danish.
11. Mayhew P, Muang NA, Mirrless-Black C. *The 1992 British Crime Survey (Home Office research study 132)*. London: Home Office Research and Statistics Department; 1993.
12. Melhuus K, Sorensen K. Violence 1994 – Oslo legevakt. *Tidsskrift Norske Laegeforeningen* 1997;**117**:230–5 in Norwegian.
13. Morrissey TB, Byrd CR, Deitch EA. The incidence of recurrence penetrating trauma in an urban trauma Center. *J Trauma* 1991;**31**:1536–8.
14. Nordic Medico Statistical Committee. *NOMESCO classification of external causes of injuries*. 3rd revised edition. Copenhagen, Denmark: NOMESCO; 1997.
15. Schwarz D, Grisso J, Milles CG, Holmes JH, Wishner AR, Sutton RL. A longitudinal study of injury morbidity in an African–American population. *J Am Med Assoc* 1994;**271**:755–60.
16. Shepherd JP, Shapland M, Pearce NX, Scully C. Pattern, severity and aetiology of injuries in victims of assault. *J Roy Soc Med* 1990;**83**:75–8.
17. Sims DW, Bivins BA, Obeid FN, Horst HM, Sorensen VJ, Fath JJ. Urban trauma: a chronic recurrence disease. *J Trauma* 1989;**29**:940–7.
18. Sivarajasingamh V, Shepherd JP, Matthews K, Jones S. Trends in violence in England and Wales 1995–2000: an accident and emergency perspective. *J Public Health Med* 2002;**24**:219–26.
19. Tellez MG, MacKersie RC, Morabito D, Shagoury C, Heye C. Risks, costs, and the expected complication of re-injury. *Am J Surg* 1995;**170**:660–4.

Paper III

Injury, Int. J. Care Injured (2006) **xxx**, xxx—xxx

ELSEVIER

INJURY
INTERNATIONAL JOURNAL OF THE CARE OF THE INJURED

www.elsevier.com/locate/injury

What is the lifetime risk of contact with an A&E Department or an Institute of Forensic Medicine following violent victimization?

Christian Faergemann [a,*], Jens M. Lauritsen [a,b], Ole Brink [c], Henrik Stovring [d]

[a] *Accident Analysis Group, Department of Orthopaedics, Odense University Hospital, Sdr. Boulevard 29, 5000 Odense C, Denmark*
[b] *Institute of Public Health, University of Southern Denmark, J.B. Winslows Vej 9A, 5000 Odense C, Denmark*
[c] *Department of Orthopaedics, Aarhus University Hospital, Tage Hansens Gade 2, 8000 Aarhus C, Denmark*
[d] *Research Unit for General Practice, University of Southern Denmark, J.B. Winslows Vej 9A, 5000 Odense C, Denmark*

Accepted 2 May 2006

KEYWORDS
Epidemiology;
Violence;
Risk;
Incidence;
Injuries

Summary

Objective: The aim of the study was to estimate the age and gender specific incidence rates of first time contact with an A&E Department and/or an Institute of Forensic Medicine due to violent victimization in a Danish low-risk urban population and, secondly to estimate the corresponding lifetime risk of violence based upon these incidence rates.
Methods: All first time contacts of victims of violence with the A&E Department at Odense University Hospital and/or the Institute of Forensic Medicine, University of Southern Denmark 1991—2002 were included. Based on estimated age and gender specific annual incidence rates of first time violence and on the survival rates of the background population, the lifetime risk was estimated assuming calendar time stationarity of incidence and survival rates.
Results: The overall annual incidence rate of first time violence was 9.2 [95% CI: 9.0—9.4] per 1000 population/year for males and 2.6 [95% CI: 2.5—2.7] per 1000 population/year for females. The estimated lifetime risk was 0.440 [95% CI: 0.438—0.442] for males and 0.180 [95% CI: 0.178—0.181] for females. The highest cumulative risk for

* Corresponding author. Tel.: +45 6541 2283.
E-mail address: christian.faergemann@ouh.fyns-amt.dk (C. Faergemann).

0020-1383/$ — see front matter
doi:10.1016/j.injury.2006.05.004

both males and females was in the age group 15–24 years, 0.192 [95% CI: 0.188–0.195] for males and 0.048 [95% CI: 0.046–0.051] for females.
Conclusion: The current study shows, that even in a country with a relatively low risk of violent victimization a considerable part of the population over a lifetime will need medical assistance after violent victimization.

Introduction

Compared with many other Western countries Denmark is a low-risk country when it comes to the risk of violent victimization. However, according to a Danish survey 42% of the females and 9% of the males avoid empty or desolate parts of cities because of an assumed risk of exposure to violence or sexual assault.[15]

In Denmark, as in many other countries, studies based on crime statistics have supported a growing public concern about violence following an increase in the frequency of violence reported to the police.[4] In contrast, previous Accident and Emergency (A&E) Department based Danish studies have shown a significant decrease in the annual incidence rates of violence.[3,28]

Several papers have described the lifetime prevalence or the lifetime exposure to violence.[3–5,9,12,15,21–24,27,28] These papers are cross-sectional prevalence studies describing the proportion of respondents exposed to violence at least once in their lifetime from birth and until they were sampled for the study. Unfortunately, differences in methodology and different cultural meanings of violence make these studies less comparable. A different and valuable strategy would be an estimation of the lifetime risk of violence based on the age-specific incidence rates of first time violence and the survival rates of the background population.[16] For the second strategy to work precise estimates of age and gender specific annual incidence rates of first time physical violent victimization are required in order to take the phenomenon of recurrent violent victimization in to account. Data from hospital A&E Departments may serve as a reliable data source for such estimation. No previous study has attempted to estimate the annual incidence of first time violent victimization leading to A&E Department or forensic medicine contact and the corresponding lifetime risk of violent victimization.

Therefore, the aim of the study was to estimate the age and gender specific incidence rates of first time contact with an A&E Department or an Institute of Forensic Medicine due to violent victimization in a Danish low-risk urban population and secondly, to estimate the corresponding lifetime risk of violence based upon these incidence rates.

Materials and methods

Deliberate physical interpersonal violence was defined according to the criteria of the World Health Organisation.[7] The population base for this study was the Odense Municipality in Denmark in the period 1991–2002. All victims of violence treated at the open access A&E Department at Odense University Hospital or subjected to medicolegal autopsy at the Institute of Forensic Medicine (IFM), University of Southern Denmark were included as cases. The Odense Municipality is a geographically well-defined urban area with a population of 185,000 inhabitants, mainly consisting of the city of Odense. The municipality has only one A&E Department, the one at Odense University Hospital, and one IFM, the one at the University of Southern Denmark.

The cases for the study were included prospectively and consecutively as they presented themselves at the A&E Department for treatment. Data on these cases were extracted from the patient registration system. The system includes self-reported information coded with the NOMESCO classification.[20] Trained staff carries out all registration of 37,000 trauma patients that are treated at the A&E Department annually. The cases from the IFM were identified by a complete review of all autopsy reports carried out by the first author. For all cases that were in compliance with the study case definition information on age, sex, and incident was obtained from the patient registration system, medical records and/or autopsy reports.

In Denmark all registered inhabitants have a unique civil registry number (cpr-number), which follows each individual for his/her entire life. In the study we defined an individual as a person with a cpr-number. The cpr-number was used to identify individuals with recurrent incidents. Fig. 1 summarizes the inclusion and exclusion of individuals and incidents for the study. In the study period 14,316 incidents of deliberate interpersonal violence involving 10,225 different individuals met the inclusion criteria. Nine individuals and their nine incidents were excluded as they did not have a cpr-number at the time of violence. Those victims were immigrants who had not yet been assigned a cpr-number. A 5-year run-in period from 1986 to 1990 was defined after analysis of the proportion of individuals victimized in the study period 1991–

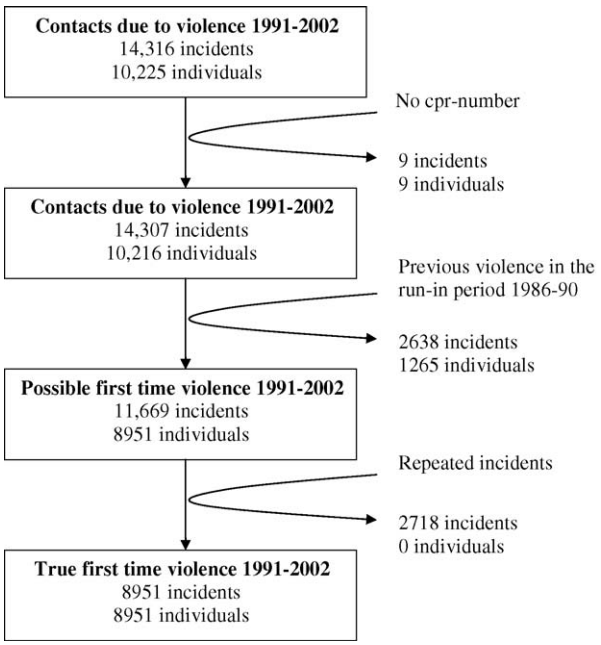


Figure 1 The inclusion and exclusion of incidents and individuals and the use of a run-in period.

2002 who were also recorded as victims in the A&E Department register prior to the study period. For each of the remaining individuals the first incident of violence was identified taking the 5-year run-in period into account. All individuals who were victims of violence in the study period 1991–2002 as well as in the run-in period 1986–1990 were excluded from the study. Additionally, all repeated incidents (incident number two or more) in each individual were excluded leaving 8951 true first time incidents of violence for the study.

Statistics

STATA 8™ was used in all statistical analyses. The population at risk was estimated by using age and gender specific mid-year population counts in the population registry. Those who had been victims of violence in the run-in period were deducted from the population at risk. The age of the victims was divided into different "social" age groups: children (0–14 years), adolescent (15–24 years), young adults (25–39 years), middle ages adults (40–59 years), and elderly (60 years or more). Based on the corrected population at risk, gender specific annual incidence rates of first time exposure to violence within the age groups were estimated. Poisson regression was used to analyse whether any trend in the gender specific annual incidence rates of first time exposure to violence within the age groups was present in the study period.

The estimate of the lifetime risk of becoming a victim of violence was based on the estimated age and gender specific annual incidence rates of first time exposure to violence and the survival rates of the background population.[16] The estimation assumed calendar time stationarity of incidence rates.[16] Basically, the formula sums up the products of the age-specific probability of being at risk (alive and no previous victimization) with the age-specific rate of becoming victimized. The lifetime risk of exposure to violence was defined as the cumulative age-specific risk from birth to age 99 years in the population.

Additionally, the cumulative gender specific risk of exposure to violence within different age groups was estimated by summing up age-specific (1-year interval) incidence rates over all ages in that age group. Confidence intervals were calculated using bootstrap techniques (STATA command: bootstrap).

The study was approved by the National Data Protection Agency. As the study was a register-based study no approval from the Biomedical Research Ethics Committee was needed.

Results

A total of 8951 first time contacts of victims of violence attending the A&E Department or sub-

Table 1 The number of cases, the population, and the gender specific annual incidence rates of first time exposure to violence stratified into different age groups

Age group	Males					Females				
	n	Population	Incidence	95% CI	Poisson*	*n*	Population	Incidence	95% CI	Poisson*
0–14	621	182893	3.4	3.1–3.7	0.070	297	177338	1.7	1.5–1.9	0.767
15–24	2855	126307	22.6	21.8–23.4	0.418	739	153113	4.8	4.5–5.2	0.056
25–39	1910	170957	11.2	10.7–11.7	0.078	770	227501	3.4	3.2–3.6	0.109
40–59	856	135699	6.3	5.9–6.7	0.012↓	493	224054	2.2	2.0–2.4	0.335
60–	139	78496	1.8	1.5–2.1	0.250	271	192743	1.4	1.2–1.6	0.749
All	6381	694292	9.2	9.0–9.4	<0.001↓	2570	974749	2.6	2.5–2.7	0.459

* *p*-values refer to Poisson regression for change in the annual incidence in the study period 1991–2002. Arrows indicate the direction of change if $p < 0.05$.

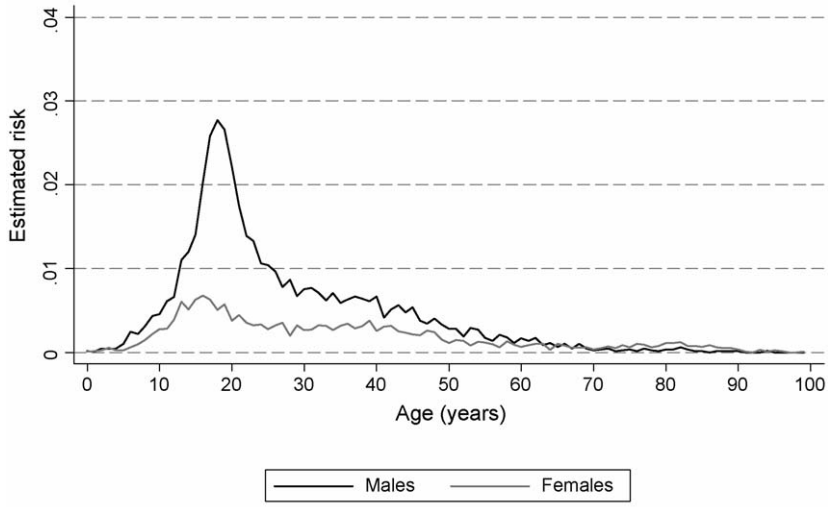


Figure 2 The estimated age-specific annual risk of contact with an A&E Department or IFM due to violence, stratified by gender.

jected to medicolegal autopsy at the IFM were defined as cases for the study, 6381 (71%) were males and 2570 (29%) were females. The median age was 23 years (0—94 years) for males and 29 years (0—99 years) for females (Mann—Whitney, $p < 0.001$).

Table 1 shows the number of cases, the population at risk, and the annual gender specific incidence rates of first time violence stratified into different age groups. The overall incidence rate of first time violence was 9.2 per 1000 population/year for males [95% CI: 9.0—9.4] and 2.6 per 1000 population/year for females [95% CI: 2.5—2.7]. The incidence rate was highest in the age group 15—24 years for both males and females, 22.6 per 1000 population/years [95% CI: 21.8—23.4] and 4.8 per 1000 population/year [95% CI: 4.5—5.2], respectively. For males the overall as well as the age-specific incidence rate in the age group 40—59 decreased significantly in the study period (Poisson regression, $p = 0.014$ and $p < 0.001$). No change in the overall or the age-specific incidence rates was observed for females.

Fig. 2 shows the estimated age-specific risk of contact with an A&E Department and/or an IFM due to violence, stratified by gender. For males the estimated risk reached a peak in adolescence with a maximum of 0.028 at the age of 18 years. From the age of 25 years and onward the risk decreased steadily. For females the estimated risk also reached a peak in adolescence with a maximum of 0.007 at the age group of 16 years. Another peak in the estimated risk occurred among the elderly females.

Fig. 3 shows the estimated cumulative risk of contact with an A&E Department and/or an IFM

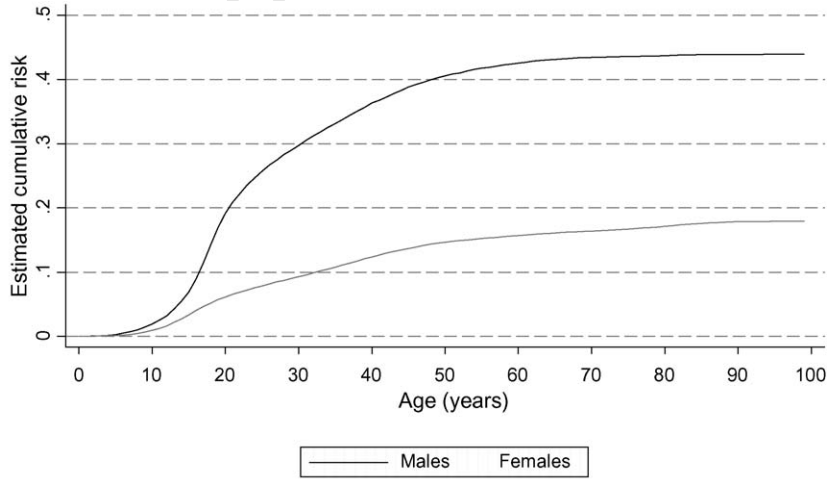


Figure 3 The estimated cumulative age-specific risk of contact with an A&E Department or IFM due to violence, stratified by gender.

Table 2 The cumulative risk of violent victimization within different age intervals of life

Age group	Males		Females	
	Risk	95% CI	Risk	95% CI
0–14	0.055	0.055–0.055	0.027	0.027–0.027
15–24	0.192	0.188–0.195	0.048	0.046–0.051
25–39	0.110	0.106–0.114	0.045	0.043–0.048
40–59	0.067	0.063–0.072	0.035	0.032–0.038
60–	0.016	0.014–0.018	0.023	0.021–0.026

due to violence, stratified by gender. For males the cumulative risk increased steeply in the adolescence. From the mid-20s the cumulative risk increased more steadily, and for the elderly males the cumulative risk was almost constant. For females the cumulative risk increased steadily from adolescence till old age. The estimated lifetime risk (cumulative risk at age 99 years) was 0.440 for males [95% CI: 0.438–0.442] and 0.180 for females [95% CI: 0.178–0.181]. Table 2 shows the cumulated risk of violent victimization within different age intervals of life. In adolescence (15–24 years) the cumulated risk of violent victimization is 0.192 for males [95% CI: 0.188–0.195] and 0.048 for females [95% CI: 0.046–0.051].

Discussion

Interpersonal violence may have serious physical and mental health consequences for the affected individuals. The present study estimates that 44% of the males and 18% of the females in a Danish urban population will at least once in their lifetime on average become victims of violence leading to contact with an A&E Department or an IFM if the current incidence and mortality rates are stable. Furthermore, the study shows that of those victimized for one half of the males and one third of the females the victimization will occur in adolescence when they are between 15 and 24 years of age.

For the sampling of valid study population data we first employed the unique Danish civil registration system to separate individuals with only one incident of violence from individuals with recurrent incidents. Second, a run-in period was taken into account to verify whether an earlier incident had occurred prior to the study period. Third, we had access to reliable age and gender specific population counts and survival rates of the background population which made it possible to estimate the incidence rates and the lifetime risk.

The estimated incidence rates and risks of our study concern only those victims of violence who required medical attention at the A&E Department and/or a medicolegal autopsy at the IFM. Victims of violence seeking medical attention at the general practitioners, at neighbouring hospitals, or not at all were not included in the study. A previous study from Odense Municipality has shown that about 11% of all injuries, mostly of a minor nature, are treated by the general practitioners.[18] An analysis of data from the same study region (approx. radius of 45 km) has shown that only 2% of all victims of violence from Odense Municipality seek medical attention at the neighbouring hospitals 45 km away.[11] Unfortunately, we have limited information about violence which has not been registered in the health care or forensic medical systems. Preliminary results indicate that 13% of all registered victims of violence in the Odense Municipality are solely registered by the police and have had no contact with the health care or forensic medical systems (Faergemann, unpublished).

Our sampling methods may lead to an underestimation of the incidence rates and risks. Especially, the estimated rates and risks of becoming a victim in a dependent relationship with the perpetrator, for example intimate partner violence and child abuse, is often unrecognized by the A&E Department staff.[14,19] Unfortunately, we have no studies describing the size of this problem in Denmark. On the other hand, the method of using a run-in period for determining whether or not an incident is a true first incidence may lead to a slight overestimation of incidence rates and risks. Individuals experiencing an event at age 60 may have had an event in their youth which we have no recording of. We expect this to be a small problem as only 4% were identified as having had events more than 5 years apart.

In the estimation of cumulative risks including lifetime risk, the assumption of time homogeneity implies stable incidence and survival rates. Accordingly, the obtained cumulative risk estimates should be interpreted as estimates pertaining to a hypothetical population subject to the age-specific victimization and mortality rates observed in the study period. The observed decrease in age-specific victimization rates among males similarly implies that the lifetime risk should be interpreted as the average lifetime risk over the period. Any assumptions of time homogeneity of such basic parameters in a population over a century are very crude in most practical situations. However, several methods in modern epidemiology are based on

time homogeneity assumptions, and we find that the estimates are still useful for comparing populations across time and location.

In our study we defined the lifetime risk as the cumulative risk from birth until the age of 99 years which was the age of the oldest victim in the study. In stead we could have chosen the gender specific mean life expectancy at birth as the cut off point in the estimations. However, from the age of 60 year and onward the number of first time incidents of violence was small and the increase in the cumulative time risk from that age was very limited. If the lifetime risk was defined as the cumulative risk from birth until the age of 60 year the lifetime would have been 0.424 [95%: 0.422—426] for males and 0.156 [95% CI: 0.155—0.158] for females. Due to the mentioned low number of cases among the elderly the results covering the age of 60 year of more is associated with less reliability.

Our study estimated the overall incidence rates and risks of contacts due to all kind of physical deliberate interpersonal violence. Unfortunately, we had no reliable information available about the perpetrator and the typology of the violent incidents. Especially, estimation of lifetime risks of different types of violence would have been relevant.

Very few studies of incidence rates are comparable to our study. Previous studies have described the incidence rates of all hospital or forensic medicine registered violence, whereas no studies have dealt only with the first time contacts. In the present study we found a significant decrease in the annual incidence rate of first time contact with the A&E Department and/or the IFM due to violence. In a previous study from the Odense Municipality the overall incidence rate of all hospital registered violence was 5.7 per 1000 population/year showing a decreasing tendency in the period 1988—1996.[27] Another Danish study based on hospital and forensic medicine data has shown a similar size and trends in the overall annual incidence rate of violence.[3] In the present study the highest age-specific incidence rate of first time exposure to violence was in the age group 15—24 years which is consistent with other studies.[3,4,10,26]

The estimated lifetime risk in our study is comparable to only a few other studies. The majority of other studies are cross-sectional surveys describing the proportion of respondents exposed to violence at least once in their lifetime from birth until sampled in the study defined as the lifetime prevalence or lifetime exposure. Furthermore, differences in methodology and different definitions or cultural concepts of violence make a comparison of different studies less meaningful. In a previous study from the Odense Municipality based on hospital data from the period 1988 to 1996 the estimated lifetime risk of violence was 45% for males and 21% for females.[27] Although, the results of this study are consistent with ours, the study was based on incidence rates of all victims who had been registered at an A&E Department including recurrent incidents, and no run-in period had been taken into account.[27]

A survey of intimate partner violence against women based on patients visiting gynaecology clinics in the five Nordic countries revealed lifetime prevalences of any physical abuse of between 38 and 66%.[29]

Numerous surveys based on A&E Department populations have described lifetime prevalences of domestic or intimate partner violence. In surveys from US or Canada the lifetime prevalences was 12% for violence against males and ranged from 34 to 58% for violence against females.[1,6,8,13,22] In similar studies from UK or New Zealand the lifetime prevalences were 22% for violence against males and between 21 and 44% for violence against females.[2,17,25]

Population based surveys have revealed different lifetime prevalences of violence. In Danish surveys of adults aged 18 years or more between 33 and 36% of the males and between 19 and 24% of the females had been exposed to violence or threats of violence at least once in their life.[5,15,28] In a similar American survey of adults aged 18 years or more (mean age = 46 years) half of the respondents reported that they had been a victim of some form of interpersonal violence at least once in their lifetime.[9] In an American study of inner-city youth aged 14—19 years (median age = 17 years) 73% of the boys and 26% of the girls had been victims of violence.[22] In other American studies the overall lifetime exposure to violence among young adults ranged from 70 to 82%.[12,23,24]

Conclusions

The current study shows that even in a country with a relatively low risk of violent victimization a considerable part of the population will over a lifetime need medical assistance after violent victimization. Further studies should attempt to estimate incidence rates and risks in specific subgroups with a high probability of violent victimization. These groups should be specifically addressed in the planning of preventive efforts. Our study has already indicated that a 50% reduction in the frequency violence among adolescents and young adults (15—24 years) will reduce the lifetime risk with about half among males and one-quarter among females.

Acknowledgements

This study was made possible by grants from the Institute of Clinical Research at the University of Southern Denmark, the Dagmar Marshall Foundation, Østifterne Insurance Company, Grethe and Sigurd Pedersen's Foundation, and the Funen County. The authors work was independent of the funding sources.

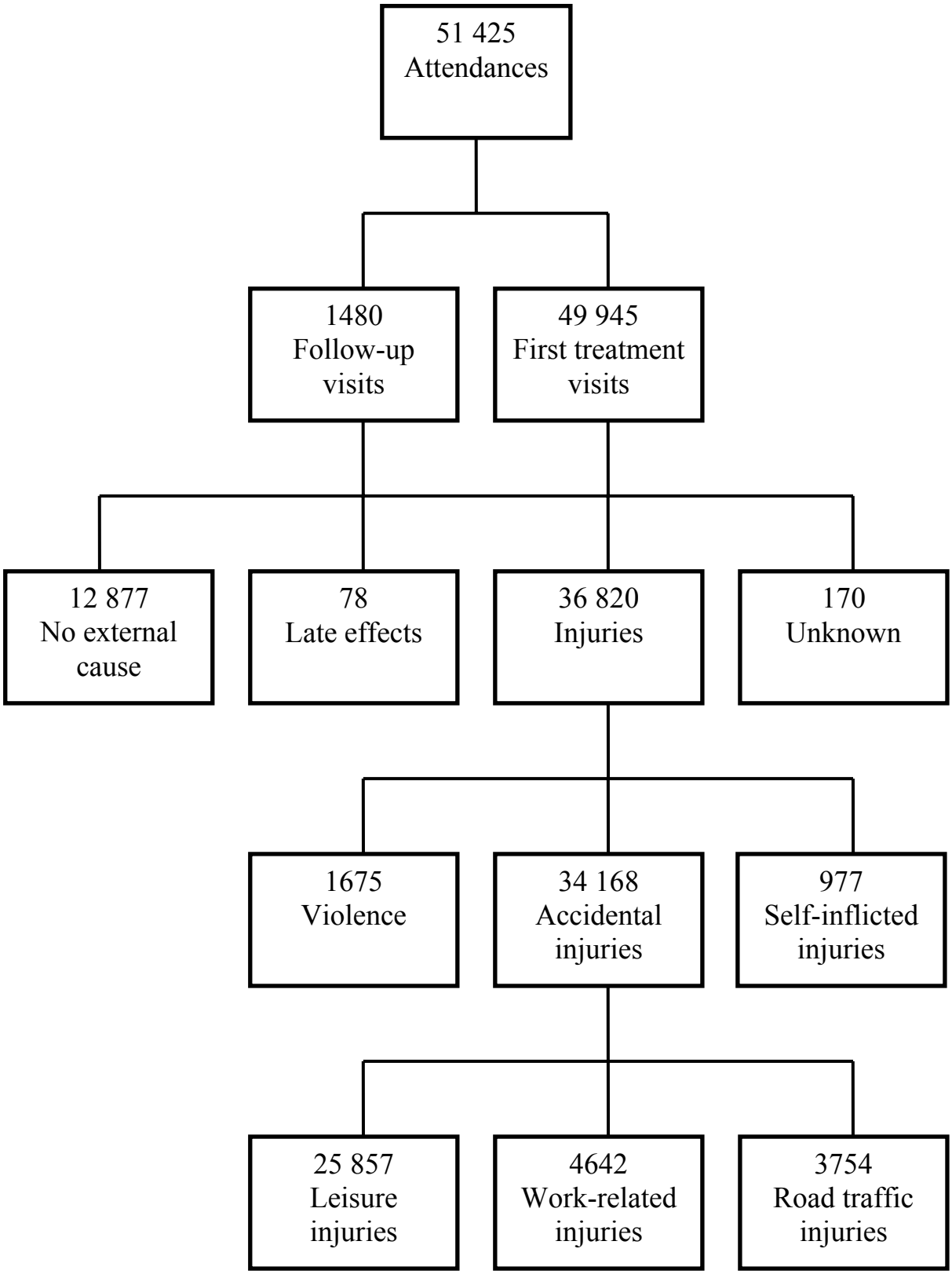
References

1. Abbott J, Johnson R, Koziol-McLain J, Lowenstein SR. Domestic violence against women: incidence and prevalence in an emergency department. JAMA 1995;273:486—92.
2. Boyle A, Todd C. Incidence and prevalence of domestic violence in a UK emergency department. Emerg Med J 2003;20:438—42.
3. Brink O, Bitch O, Petersen KK, et al. Two decades of violence. A cohort study from the Danish municipality of Aarhus. Dan Med Bull 2002;49:64—7.
4. Brink O, Charles AV, Sabroe S, et al. Less violence and more police reported assaults. Nordisk Tidsskrift for Kriminalvidenskab 1997;84:103—14 [in Danish].
5. Christensen E, Koch-Nielsen I. Violence outside and at home Copenhagen: The Danish National Institute of Social Research; 1992 [in Danish].
6. Cox J, Bota GW, Carter MC, et al. Domestic violence. Incidence and prevalence in a Northern emergency department. Can Fam Physician 2004;50:90—8.
7. Dahlberg LL, Krug EG. Violence-global public health problem. In: Krug EG, Dahlberg LL, Mercy JA, et al., editors. World report on violence and health. Geneva, Switzerland: World Health Organisation; 2002. p. 3—7.
8. Dearwater SR, Coben JH, Campbell JC, et al. Prevalence of intimate partner abuse in women treated at community hospital emergency departments. JAMA 1998;280:433—8.
9. Elliot DM. Traumatic events: prevalence and delayed recall in the general population. J Consul Clin Psychol 1997;65:811—20.
10. Engeland A, Kopjar B. Injuries from violence in Norway—analysis of the data from the Norwegian national injury sample registry. Tidsskr Nor Laegeforen 2000;120:714—7 [in Norwegian].
11. Faergemann C. Victims of violence treated in the hospitals of Funen County 1999—2003. In: Larsen LB, Larsen MS, Lauritsen JM, editors. Accident victims treated at the A&E department, Odense University Hospital 2003. Odense, Denmark: Accident Analysis Group, Odense University Hospital; 2004. p. 10—20 [in Danish].
12. Fitzpatrick KM, Boldizar JP. The prevalence and consequences of exposure to violence among African-American youth. J Am Acad Cold Adolesc Psychiatr 1993;32:424—30.
13. Gin NE, Rucker L, Frayne S, et al. Prevalence of domestic violence among three ambulatory care internal medicine clinics. J Gen Int Med 1991;6:317—22.
14. Goldberg WR, Tomlanovich MC. Domestic violence victims in the emergency department. New findings. JAMA 1984;251:3259—64.
15. Helweg-Larsen K. Violence and sexual assault. In: Kjoller M, Rasmussen NK, editors. Danish health and morbidity survey 2000... & trends since 1987. Copenhagen, Denmark: National Institute of Public Health; 2002 . p. 466—79 [in Danish].
16. Keiding N. Age-specific incidence and prevalence: a statistical perspective. J R Statist Soc 1991;154:371—412.
17. Koziol-McLain J, Gardiner J, Batty P, et al. Prevalence of intimate partner violence among women presenting to an urban adult and paediatric emergency care department. NZMJ 2004;117:U1174.
18. Lauritsen J. Injury and facility contacts. A random population sample. Report No. 9. Institute for Health Economy and Health Care. Odense, Denmark: University of Odense 1987 [in Danish].
19. McGrath ME, Bettacchi A, Duffy SJ, et al. Violence against women: provider barriers to intervention in emergency departments. Acad Emerg Med 1997;4:297—300.
20. Nordic Medico Statistical Committee. NOMESCO classification of external causes of injuries. 3rd rev ed. Copenhagen: Nordic Medico Statistical Committee; 1997.
21. Perez-Smith AM, Albus KE, Weist MD. Exposure to violence and neighbourhood affiliation among inner-city youth. J Clin Child Psychol 2001;30:464—72.
22. Roberts GL, O'Toole BI, Lawrence JM, et al. Prevalence of domestic violence in an emergency department. Ann Emerg Med 1996;27:741—53.
23. Scarpa A. Community violence exposure in a young adult sample. Lifetime prevalence and socioemotional effects. J Interpers Violence 2001;16:36—53.
24. Scarpa A, Fikretoglu D, Bowser F, et al. Community violence exposure in University students. A replication and extension. J Interpers Violence 2002;17:253—72.
25. Sethi D, Watts S, Zwi A, et al. Experience of domestic violence by women attending an inner city accident and emergency department. Emerg Med 2004;21:180—8.
26. Sivarajasingam V, Shepherd JP, Matthews K, et al. Trends in violence in England and Wales 1995—2000: an accident and emergency perspective. J Public Health Med 2002;24:219—26.
27. Skov O, Mazanti FK, Röck ND. The incidence of hospital-treated injuries related to violence in the city of Odense 1988 to 1996. Ugeskr Laeger 1999;161:1407—9 [in Danish].
28. Sundaram V, Curtis T, Helweg-Larsen K, et al. Can we compare violence data across countries? Circumpolar Health 2003;63(Suppl. 2):389—96.
29. Wijma B, Schei B, Swahnberg K, et al. Emotional, physical, and sexual abuse in patients visiting gynaecology clinics: a Nordic cross-sectional study. Lancet 2003;361:2107—13.

Appendix A

Odense University Hospital

APPENDIX A. Attendances at the A&E department, Odense University Hospital 2002



Appendix B

Registration of violence at the Odense University Hospital

B1. VOLDSOFRETS CPR.-NR. : __ __ __ __ __ __ ----__ __ __ __

C5. ADRESSE FOR VOLDSHANDLINGEN:

Beskriv _____

***C6. BOLIG* (Folkeregister adresse)**

Angiv, hvorvidt voldshandlingen fandt sted i privat bolig, samt i hvis bolig voldshandlingen fandt sted.

(Sæt kun ét kryds)

0. Voldshandlingen skete ikke i privat bolig ..... ☐ 0
1. Voldsofrets private bolig ..... ☐ 1
2. Voldsudøverens private bolig..... ☐ 2
3. Anden persons private bolig..... ☐ 3
9. Ukendt eller uoplyst..... ☐ 9

D1. ANTAL VOLDSUDØVERE

Angiv antallet af aktive voldsudøvere.

(Sæt kun ét kryds)

1. Én voldsudøver ..... ☐ 1
2. To voldsudøvere ..... ☐ 2
3. 3-5 voldsudøvere..... ☐ 3
4. 6 eller flere voldsudøvere..... ☐ 4
9. Ukendt eller uoplyst ..... ☐ 9

D2. HVEM VAR VOLDSUDØVEREN

Angiv kun den mest aktive person ved voldshandlingen.

(Sæt kun ét kryds)

0. Ukendt person for voldsofret..... ☐ 0
1. Kendt person for voldsofret
   - 10. Nuværende ægtefælle, samlever eller partner..... ☐ 10
   - 11. Tidligere ægtefælle, samlever eller partner ..... ☐ 11
   - 12. Barn eller barnebarn ..... ☐ 12
   - 13. Forældre eller bedsteforældre..... ☐ 13
   - 14. Andet familiemedlem (stedforældre m.m.)..... ☐ 14
   - 15. Ven eller veninde..... ☐ 15
   - 16. Bekendt..... ☐ 16
   - 17. Øvrighedsperson (lærer, pædagog, arbejdsgiver m.m.) ..... ☐ 17
   - 18. Anden kendt person, beskriv _____ 18
   - 19. Person kendt, men uoplyst..... ☐ 19
2. Politimyndighed..... ☐ 2
9. Uoplyst ..... ☐ 9

D3. VOLDSUDØVERENS KØN

Ved flere aktive voldsudøvere angives kun kønnet på den mest aktive voldsudøver.

(Sæt kun ét kryds)

1. Mand eller dreng ..... ☐ 1
2. Kvinde eller pige ..... ☐ 2
9. Ukendt eller uoplyst ..... ☐ 9

D4. VOLDSUDØVERENS ALDER

Ved flere aktive voldsudøvere angives kun alderen på den mest aktive voldsudøver.

(Sæt kun ét kryds)

1. Barn (0-14 år) ..... ☐ 1
2. Ung (15-24 år) ..... ☐ 2
3. Voksen (25-64 år) ..... ☐ 3
4. Ældre (65 år eller mere) ..... ☐ 4
9. Ukendt eller uoplyst ..... ☐ 9

E1. VOLDSUDØVERENS BRUG AF VÅBEN

Ved brug af flere forskellige slags våben angives alle våbnene.

(Sæt mindst ét kryds)

0. Intet brug af våben ..... ☐ 0
1. Skydevåben (pistol, gevær m.m.) ..... ☐ 1
2. Skarpt eller spidst våben (kniv, økse, flaske, glas m.m.) ..... ☐ 2
3. Slagvåben (kølle, knippel, bælte, cykelkæde m.m.) ..... ☐ 3
4. Andet, beskriv _____ 4
9. Uoplyst eller ukendt ..... ☐ 9

Dato : _____

Sekretærs initialer : _____

Opstår der problemer i forbindelse med udfyldelsen af registreringsskemaet rettes henvendelse til :

Christian Færgemann, ph.d.-studerende
Ulykkes Analyse Gruppen
Lokal 2283 (Privat 63122329)
christian.faergemann@ouh.fyns-amt.dk

Appendix C

Registration of violence at the Odense Police

Registreringsskema til brug hos Odense Politi i forbindelse med anmeldelse af voldshandlinger

INDLEDNING:
I forbindelse med et forskningsprojekt omhandlende voldsskader skal der over en et-årig periode foretages en udvidet registrering af alle voldsskader i Odense. Denne registrering skal foregå hos Odense Politi samt på skadestuen ved Odense Universitetshospital. Forskningsprojektet udføres ved Ulykkes Analyse Gruppen på Odense Universitetshospital i samarbejde med Retsmedicinsk Institut og Odense Politi.

VEJLEDNING:
Efterfølgende registreringsskema skal udfyldes, når et voldsoffer uanset bopæl anmelder en voldshandling på én af politistationerne i Odense Politikreds i perioden **1. marts 2003 til og med 29. februar 2004.**

Registreringsskemaet består af **4 sider** og indeholder :

A. Oplysninger til Odense Politi
B. Oplysninger om voldsoffer
C. Oplysninger om voldshandling
D. Oplysninger om voldsudøver
E. Oplysninger om brug af våben

Opstår der spørgsmål eller uklarheder i forbindelse med udfyldelsen af registreringsskemaet, kan der rettes henvendelse til projektansvarlige:

Christian Færgemann, læge
Ulykkes Analyse Gruppen
Odense Universitetshospital
65412283 (Privat 63122329)

Ole Skov, overlæge, ph.d.
Ulykkes Analyse Gruppen
Odense Universitetshospital
65412283

A. OPLYSNINGER TIL ODENSE POLITI

A1. Politiets journalnr. : _____

B. OPLYSNINGER OM VOLDSOFFER

B1. Voldsofrets cpr.-nr. : __ __ __ __ __ __ ----__ __ __ __

C. OPLYSNINGER OM VOLDSHANDLING

C1. Dato for voldshandling : _____

C2. Tidspunkt for voldshandling : _____

C3. Anmeldelsesdato : _____

C4. Sted for voldshandling : _____(f.eks. Franck A)

C5. Adresse for voldshandling : _____(f.eks. Byvej 99)

C6. Det følgende spørgsmål omhandler stedet for voldshandlingen. Der spørges om, hvorvidt voldshandlingen fandt sted i privat bolig, samt i hvis bolig voldshandlingen fandt sted.

Skete voldshandlingen i privat bolig (Folkeregister adresse)? ***(Sæt kun ét kryds)***

0. Voldshandlingen skete ikke i privat bolig ..... ☐ 0
1. Voldsofrets private bolig ..... ☐ 1
2. Voldsudøverens private bolig ..... ☐ 2
3. Anden persons private bolig ..... ☐ 3
9. Ukendt eller uoplyst ..... ☐ 9

D. OPLYSNINGER OM VOLDSUDØVER

D1. Det følgende spørgsmål omhandler antallet af voldsudøvende personer. Der angives antallet af aktive voldsudøvere i forbindelse med voldshandlingen.

Hvor mange aktive voldsudøvere deltog? ***(Sæt kun ét kryds)***

1. Én voldsudøver ..... ☐ 1
2. To voldsudøvere ..... ☐ 2
3. 3-5 voldsudøvere ..... ☐ 3
4. 6 eller flere voldsudøvere ..... ☐ 4
9. Ukendt eller uoplyst ..... ☐ 9

D2. Det følgende spørgsmål omhandler den voldsudøvende persons forhold til ofret. Ved flere voldsudøvende personer angives kun den person, der var mest aktiv i forbindelse med voldshandlingen.

Hvem var voldsudøveren? ***(Sæt kun ét kryds)***

0. Person ukendt af voldsofret ☐ 0

1. Kendt person for voldsofret

10. Nuværende ægtefælle, samlever eller partner ☐ 10

11. Tidligere ægtefælle, samlever eller partner ☐ 11

12. Barn eller barnebarn ☐ 12

13. Forældre eller bedsteforældre ☐ 13

14. Andet familiemedlem (stedforældre m.m.) ☐ 14

15. Ven eller veninde ☐ 15

16. Bekendt ☐ 16

17. Øvrighedsperson (lærer, pædagog, arbejdsgiver m.m). ☐ 17

18. Anden kendt person af voldsofret, beskriv _____ 18

19. Person kendt af voldsofret, men uoplyst ☐ 19

2. Politimyndighed ☐ 2

9. Person uoplyst ☐ 9

D3. Det følgende spørgsmål omhandler voldsudøverens køn. Ved flere aktive voldsudøvere angives kun kønnet på den mest aktive voldsudøver.

Den mest aktive voldsudøvers køn ***(Sæt kun ét kryds)***

1. Mand eller dreng ☐ 1

2. Kvinde eller pige ☐ 2

9. Ukendt eller uoplyst ☐ 9

D4. Det følgende spørgsmål omhandler voldsudøverens alder. Ved flere aktive voldsudøvere angives kun alderen på den mest aktive voldsudøver.

Den mest aktive voldsudøvers alder ***(Sæt kun ét kryds)***

1. Barn (0-14 år) ☐ 1
2. Ung (15-24 år) ☐ 2
3. Voksen (25-64 år) ☐ 3
4. Ældre (65 år eller mere) ☐ 4
9. Ukendt eller uoplyst ☐ 9

E. OPLYSNINGER OM BRUG AF VÅBEN

E1. Det følgende spørgsmål omhandler hvilke(t) våben voldsudøveren anvendte i forbindelse med voldshandlingen. Ved brug af flere forskellige slags våben angives alle våbnene.

Hvilke(t) våben anvendte voldsudøveren? ***(Sæt mindst ét kryds)***

0. Intet brug af våben ☐ 0
1. Skydevåben (pistol, gevær m.m.) ☐ 1
2. Skarpt eller spidst våben (kniv, økse, flaske, glas m.m.) ☐ 2
3. Slagvåben (kølle, knippel, bælte, cykelkæde m.m.) ☐ 3
4. Andet, beskriv _____ 4
9. Uoplyst eller ukendt ☐ 9

Appendix D

The annual proportion of repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence

APPENDIX D. The annual number and the percentage of repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence.

STUDY YEAR	N	RUN-IN YEAR									
		2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
1991	91	-	-	-	-	-	-	-	-	-	-
1992	69	-	-	-	-	-	-	-	-	-	-
1993	70	-	-	-	-	-	-	-	-	-	20 28.6%
1994	105	-	-	-	-	-	-	-	-	30 29.6%	10 9.5%
1995	72	-	-	-	-	-	-	-	22 30.6%	7 9.7%	3 4.2%
1996	57	-	-	-	-	-	-	13 22.8%	1 1.8%	3 5.3%	0 -
1997	67	-	-	-	-	-	14 20.9%	11 16.4%	7 10.4%	4 6.0%	0 -
1998	62	-	-	-	-	12 19.4%	8 12.9%	4 6.5%	4 6.5%	2 3.2%	2 3.2%
1999	72	-	-	-	22 30.1%	10 13.9%	6 8.3%	4 5.6%	2 2.8%	1 1.4%	2 2.8%
2000	71	-	-	19 26.8%	6 8.5%	3 4.2%	2 2.8%	2 2.8%	0 -	1 1.4%	0 -
2001	66	-	16 24.2%	7 10.6%	5 7.6%	7 10.6%	5 7.6%	1 1.5%	0 -	2 3.0%	0 -
2002	77	16 20.8%	8 10.4%	6 7.8%	2 2.6%	2 2.6%	3 3.9%	2 2.6%	1 1.3%	0 -	1 1.3%
All	2262	-	-	-	-	-	-	-	-	-	-

APPENDIX D. The annual number and the percentage of repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence. [CONTINUED].

RUN-IN YEAR											
1991	**1990**	**1989**	**1988**	**1987**	**1986**	**1985**	**1984**	**1983**	**1982**	**1981**	**1980**
-	35	7	7	1	5	0	2	2	0	1	0
	38.5%	7.7%	7.7%	1.1%	5.5%	-	2.2%	2.2%	-	1.1%	-
18	6	7	4	4	0	2	1	1	0	1	0
26.1%	8.7%	10.1%	5.8%	5.8%	-	2.9%	1.4%	1.4%	-	1.4%	
13	2	5	1	0	1	0	1	0	0	2	0
18.6%	2.9%	7.1%	1.4%	-	1.4%	-	1.4%	-	-	2.9%	-
10	2	2	7	4	1	2	2	0	1	0	0
9.5%	1.9%	1.9%	6.7%	3.8%	1.0%	1.9%	1.9%	-	1.0%	-	-
3	1	1	1	1	1	2	2	1	1	0	0
4.2%	1.4%	1.4%	1.4%	1.4%	1.4%	2.4%	2.8%	1.4%	1.4%	-	-
2	1	1	0	1	1	1	1	0	1	0	0
3.5%	1.8%	1.8%	-	1.8%	1.8%	1.8%	1.8%	-	1.8%	-	-
0	1	3	0	0	1	0	0	1	0	0	1
-	1.5%	4.5%	-	-	1.5%	-	-	1.5%	-	-	1.5%
2	1	1	1	0	1	0	0	0	0	0	0
3.2%	1.6%	1.6%	1.6%	-	1.6%	-	-	-	-	-	-
2	0	1	0	0	0	1	0	0	0	0	0
2.8%	-	1.4%	-	-	-	1.4%	-	-	-	-	-
0	1	0	2	0	0	0	0	1	1	1	0
-	1.4%	-	2.8%	-	-	-	-	1.4%	1.4%	1.4%	
0	0	0	0	2	0	0	0	0	0	0	0
-	-	-	-	3.0%	-	-	-	-	-	-	-
1	0	0	1	1	0	0	0	0	0	0	0
1.3%	-	-	1.3%	1.3%	-	-	-	-	-	-	-
-	192%	126	91	86	52	49	35	25	25	14	9
	8.5%	5.6%	4.0%	3.8%	2.3%	2.2%	1.5%	1.1%	1.1%	0.6%	0.4%

Appendix E

The annual proportion of non-repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence

APPENDIX E. The annual number and the percentage of non-repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence.

STUDY YEAR	N	RUN-IN YEAR									
		2001	2000	1999	1998	1997	1996	1995	1994	1993	1992
1991	1043	-	-	-	-	-	-	-	-	-	-
1992	1092	-	-	-	-	-	-	-	-	-	-
1993	982	-	-	-	-	-	-	-	-	-	95 9.7%
1994	1138	-	-	-	-	-	-	-	-	96 8.4%	73 6.4%
1995	960	-	-	-	-	-	-	-	84 8.8%	51 5.9%	35 3.6%
1996	925	-	-	-	-	-	-	73 7.9%	52 5.6%	31 3.4%	27 2.9%
1997	1033	-	-	-	-	-	69 6.7%	47 4.5%	50 4.8%	28 2.7%	23 2.2%
1998	997	-	-	-	-	85 8.5%	43 4.3%	39 3.9%	36 3.6%	31 3.1%	18 1.8%
1999	1016	-	-	-	80 7.9%	59 5.8%	35 3.4%	22 2.2%	27 2.7%	22 2.2%	14 1.4%
2000	1042	-	-	80 7.7%	52 5.0%	47 4.5%	24 2.3%	21 2.0%	18 1.7%	12 1.2%	13 1.2%
2001	1052	-	82 7.8%	57 5.4%	51 4.8%	34 3.2%	31 2.9%	10 1.0%	18 1.7%	13 1.2%	9 0.9%
2002	1025	84 8.2%	69 6.7%	36 3.5%	24 2.3%	33 3.2%	15 1.5%	12 1.2%	12 1.2%	16 1.6%	7 0.7%
All	7954	-	-	-	-	-	-	-	-	-	-

APPENDIX E. The annual number and the percentage of non-repeat victims from 1991 to 2002 who also previously had contact with the A&E department because of violence. [CONTINUED].

RUN-IN YEAR											
1991	**1990**	**1989**	**1988**	**1987**	**1986**	**1985**	**1984**	**1983**	**1982**	**1981**	**1980**
-	98	51	43	41	29	19	19	10	10	8	8
	9.4%	4.9%	4.1%	3.9%	2.8%	1.8%	1.8%	1.0%	1.0%	0.8%	0.8%
99	62	49	47	38	20	17	8	9	11	5	8
9.1%	5.7%	4.5%	4.3%	3.5%	1.8%	1.6%	0.7%	0.8%	1.0%	0.5%	0.7%
70	36	28	25	28	12	9	11	10	6	5	4
7.1%	3.7%	2.9%	2.5%	2.9%	1.2%	0.9%	1.1%	1.0%	0.6%	0.5%	0.4%
50	27	30	20	17	9	15	17	10	14	10	3
4.4%	2.4%	2.6%	1.8%	1.5%	0.8%	1.3%	1.5%	0.9%	1.2%	0.9%	0.3%
27	26	26	11	8	15	8	6	6	4	7	7
2.8%	2.7%	2.7%	1.1%	0.8%	1.6%	0.8%	0.6%	0.6%	0.4%	0.7%	0.7%
24	23	16	13	15	14	14	14	7	4	0	2
2.6%	2.5%	1.7%	1.4%	1.6%	1.5%	1.5%	1.5%	0.8%	0.4%	-	0.2%
17	21	9	13	8	10	9	6	6	6	5	5
1.6%	2.0%	0.9%	1.3%	0.8%	1.0%	0.9%	0.6%	0.6%	0.6%	0.5%	0.5%
20	13	10	11	13	3	3	5	5	2	4	5
2.0%	1.3%	1.0%	1.1%	1.3%	0.3%	0.3%	0.5%	0.5%	0.2%	0.4%	0.5%
17	13	25	11	10	3	4	7	4	2	0	2
1.7%	1.3%	2.5%	1.1%	1.0%	0.3%	0.4%	0.7%	0.4%	0.2%	-	0.2%
13	9	9	8	7	9	1	8	3	3	4	3
1.2%	0.9%	0.9%	0.8%	0.7%	0.9%	0.1%	0.8%	0.3%	0.3%	0.4%	0.3%
6	8	6	9	8	4	6	3	4	1	1	2
0.6%	0.8%	0.6%	0.9%	0.8%	0.4%	0.6%	0.3%	0.4%	0.1%	0.1%	0.2%
8	8	6	10	4	5	3	1	3	7	2	0
0.8%	0.8%	0.6%	1.0%	0.4%	0.5%	0.3%	0.1%	0.3%	0.7%	0.2%	-
-	202	147	154	125	90	67	79	58	50	39	41
	2.5%	1.8%	1.9%	1.6%	1.1%	0.8%	1.0%	0.7%	0.6%	0.5%	0.5%

Appendix F

The extracted and constructed demographic and socioeconomic variables describing cases, controls, and partners

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters.

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**New Name**	**New Categories**
IDA	D	Age (alder)	Numeric continuous variable	0	**Age difference**	1. 1 – 4 years 2. 5 years or more
IDA	D	Age of partner (alderc)	Numeric continuous variable	0		
IDA	A	Citizenship (statkod)	Four-digit country codes	0.7 %	**New citizenship**	1. Denmark 2. Other European 3. Other World 9. No information
IDA	D	Land of origin (ieland)	Four-digit country codes	0.7 %	**Ethnic origin**	1. Danish 2. 1st or 2nd generation immigrant Europe 3. 1st or 2nd generation immigrant other 9. No information
IDA	D	**Immigration status (ietype)**	1. Danish 2. 1st generation immigrant 3. 2nd generation immigrant 9. No information	0.7 %		
IDA	A	Marital status (civst)	E. Widowed from marriage F. Divorced G. Married (+ separated) L. Surviving partner O. Dissolved partnership P. Registered partnership U. Never married	0.7 %	**New marital status**	1. Never married (U) 2. Married (G,P) 3. Divorced (F,O) 4. Widowed (E,L) 9. No information (.)

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**New Name**	**New Categories**
IDA	A	Household type (ctype)	01. Single without children 02. Single with children 11. Married couple without children 12. Married couple with children 21. Reg. partnership without children 22. Reg. partnership with children 31. Couples in consensual union -/children 32. Couples in consensual union +/children 41. Cohabitant couples without children 42. Cohabitant couples with children 53. Children living away from home	0.7 %	New household type	1. Single without children (01,53) 2. Single with children (02) 3. Not single without children (11,21,31,41) 4. Not single with children (12,22,32,42) 9. No information (.)
					Living with children	1. Living with children (02,12,22,3242) 2. Not living with children (01,11,21,31,41,53) 9. No information (.)
IDA	A	Link to partner (cfelle)	Cpr-number of partner	0	**Living with partner**	1. Living with partner (link to cpr-number) 2. Not living with partner (.)
IDA	A	Adults in family (antvoksf)	Number of adults (numeric)	0.7 %	None	None
IDA	A	Children <18 yrs (anc017)	Number of children (numeric)	0.7 %	None	None
IDA	A	Adults in family (antvoksf)	Number of adults (numeric)	0.7 %	None	None
IDA	A	Status in the family (cstatus)	1. Single 2. Married women 3. Married man 4. Reg. partnership, eldest person 5. Reg. partnership, youngest person 6. Cohabitant with common children 7. Cohabitant without common children 8. Child living at home 9. Child living at home	0.7 %	None	None

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**Name**	**Categories**
IDA	A	Persons in the household (antpersf)	Number of persons (numeric)	0.7 %	**Household crowding**	1. 0 – 24 m^2 per person 2. 25 – 49 m^2 per person 3. 50 – 74 m^2 per person 4. 75 m^2 per person or more 9. No information
DRHSC	A	Size of housing (f311)	Size of household in m^2 (numeric)	1.4 %		
DRHSC	A	Size of housing (f314)	Size of household in number of rooms (numeric)	1.4 %	None	None
IDA	A	Person in household (antpersh)	Number of persons (numeric)	1.4 %	None	None
IDA	A	Children in household (antbornh)	Number of children (numeric)	1.4 %	None	None
IDA	B	Education in progress (iguud2)	8-digit code for education (numeric)	0.7 %	None	None
IDA	B	Highest vocational education completed (ekfsp)	Eight-digit code for education	0.73 %	None	None
IDA	E	Socioeconomic group I (asocio2)	Eight-digit code for socioeconomic	50.2 %	None	None
IDA	E	Socioeconomic group II (socio)	2-digit code for socioeconomic	43.7 %	None	None

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**Name**	**Categories**
IDA	E	Socioeconomic group III (pstill2)	0x-2x. Self-employed 31-33. Manager 34-37. Worker 40-41. Unemployed 50. "Efterlon" 55. Social benefit 71-73. Manager 74-77. Worker 90. Pension 91. Pupil or student 92. Pension	0.7 %	**Socioeconomic group**	1. Student (91) 2. Unemployment or sick leave (44,41,55) 3. Pension (50,90,92) 4. Worker (34-37,74-77) 5. Self-employed or manager (0x-1x,71-73) 9. No information (.)
IDA	B	Highest education obtained (hffsp)	10x. Basic school 8-10 grade 20x. General upper secondary school 25x. Vocational upper secondary school 30x. Vocational education and training 35x. Vocational education and training 40x. Short-cycle higher education 50x. Medium-cycle higher education 60x. Bachelor 65x. Long-cycle higher education 90x. No information	0.73 %	**New highest education obtained**	1. Basic upper secondary school or less (10x,20x) 2. Vocational education (25x,30x,35x) 3. Short to long-cycle higher education (40x,50x,60x,65x) 9. No information (90x)
IDA	B	Job position (discok)	Four-digit code for position	43.7 %	None	None
IDA	B	Ownership of workplace (Aejerko2)	Two-digit code for ownership	17.7 %	None	None

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**Name**	**Categories**
IDA	B	Line of business (pdb32)	Six-digit code for line of business	0.7 %	None	None
IDA	C	Unemployment rate previous year (arledgr)	Number of days per 1000 working days (numeric)	0.7 %	**New unemployment rate previous year**	0. No unemployment 1. 1 – 499 per 1000 days 2. 500 per 1000 days or more 9. No information
IDA	F	Lifetime unemployment rate (sumgrad)	Number of days per 1000 working days since 1980 (numeric)	0.7 %	**New lifetime unemployment rate**	0. Lower half 1. Higher half 9. No information
IDA	C	Annual gross income (brindk2)	Numeric in DKR	0.7 %	**New total annual household income**	1. 0 – 9999 € per year 2. 10 000 – 19 999 € per year 3. 20 000 – 29 999 € per year 4. 30 000 € or more per year 9. No information
IDA	C	Annual taxable income (skplind2)	Numeric in DKR	0.7 %	**New annual taxable household income**	1. 0 – 9999 € per year 2. 10 000 – 19 999 € per year 3. 20 000 – 29 999 € per year 4. 30 000 € or more per year 9. No information
IDA	C	Annual income from employment (slon)	Numeric in DKR	0.7 %	**New annual household income from employment**	1. 0 – 9999 € per year 2. 10 000 – 19 999 € per year 3. 20 000 – 29 999 € per year 4. 30 000 € or more per year 9. No information

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**Name**	**Categories**
DRHSC	C	National education funding (stip)	Numeric in DKR	0.7 %	None	None
DRHSC	C	Unemployment benefit (arblp)	Numeric in DKR	0	None	None
DRHSC	C	Sickness benefit A (adagp)	Numeric in DKR	0	None	None
DRHSC	C	Sickness benefit B (bdagp)	Numeric in DKR	0	None	None
DRHSC	C	Supplementary benefit (socbist)	Numeric in DKR	0	None	None
DRHSC	C	State pension (offpen)	Numeric in DKR	0	None	None
DRHSC	C	National education funding (stip)	Numeric in DKR	0.7 %	None	None
DRHSC	C	"Efterløn" (eftlon)	Numeric in DKR	0	None	None
DRHSC	C	Sickness benefit days per months (varmms)	Number of day per months	52.3 %	None	None
DRHSC	C	Sickness benefit in days per year (varsyg)	Number of days	52.3 %	None	None
DRHSC	C	Cash benefit in days per months (varmmk)	Number of day per months	52.3 %	None	None

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

APPENDIX F. Variables extracted from Statistics Denmark and construction of new variables concerning cases, controls, and partners: source, date for status, name, categories, percentage of missing among adults, new variable name, and new categories. Variables used for modelling are shown in bold characters. [CONTINUED].

EXTRACTED VARIABLES					DERIVED VARIABLES	
Source	**Date**	**Name**	**Categories**	**Missings**	**Name**	**Categories**
DRHSC	C	Other cash (belkon3)	Numeric in DKR	52.3 %	None	None
DRHSC	C	Pension in days per months (varmmv)	Number of day per months	52.3 %	None	None
DRHSC	C	State pension (varald)	Number of days	52.3 %	None	None
DRHSC	C	Early retirement (varf)	Number of days	52.3 %	None	None
DRHSC	C	"Tillidsmandspension" (vart)	Number of days	52.3 %	None	None
DRHSC	C	"Efterlon" (vare)	Number of days	52.3 %	None	None

SOURCE: IDA = Integrated Database for Labour Market Research, DRHSC = Danish Register for Health and Social Conditions.
DATE: A = 31 December, B = October, C = Cumulative for the year, D = Constant, E = Most important in year, F = Cumulative for life.

Appendix G

Selection of the most important variables within each concept for building of a model for analyses of risk factors

APPENDIX G. The selection of the most important variables within each concept for building of a model for analyses of risk factors (LHR = Likelihood ratio, DF = Degree of freedom).

CONCEPTS	VARIABLES	LHR[1]	DF	LHR	ΔLHR[2]
		Bivariate		0	1
	The victims				
By design	Age + Gender + Year	0.00		0.00	
Unemployment	Unemployment previous year	964.54	4		964.54
	Lifetime unemployment	1579.60	4		1579.60
Partnership	Marital status	1766.41	5		
	Partner	2548.32	2		
Children	Living with children	605.73	2		
Socioeconomic status	Socioeconomic group	5134.83	6		
	Highest education obtained	1793.82	4		
Household income	Gross income	3274.92	5		
	Taxable income	2157.56	5		
	Income from employment	3566.20	5		
Ethnicity	Citizenship	101.26	4		
	Immigration status	79.41	3		
	Country of origin	90.80	4		
	Ethnic origin	91.57	4		
Housing	Household crowding	293.62	5		
	The partners				
By design	Age + Gender + Year	75.23		75.23	
Demographics_p	Age difference to partner	402.12	2		402.12
Unemployment_p	Unemployment previous year_p	221.47	4		
	Lifetime unemployment_p	223.45	4		
Socioeconomics status_p	Socioeconomic group	762.86	6		
	Highest education obtained_p	1224.99	4		
Ethnicity_p	Citizenship_p	158.52	4		
	Immigration status_p	192.15	3		
	Country of origin_p	1717.52	4		
	Ethnic origin_p	196.17	4		

[1]) Likelihood ratio for bivariate analysis (including age, gender, and year.

[2]) Change in likelihood ratios when adding a new variable.

APPENDIX G. The selection of the most important variables within each concept for building of a model for analyses of risk factors (LHR = Likelihood ratio, DF = Degree of freedom). [CONTINUED].

ΔLHR² 3	ΔLHR² 4	ΔLHR² 5	ΔLHR² 6	ΔLHR² 7	ΔLHR² 8	GROUND MODEL
			The victims			
						Age + Gender + Year
						Lifetime unemployment
1452.78						
2335.58						Living with partner
	1582.73					Living with children
		5480.34				Socioeconomic group
		3498.70				
			2044.71			Gross income
			1889.44			
			2016.03			
				5498.28		Citizenship
				5480.76		
				5481.28		
				5481.26		
					2208.37	Household crowding
			The partners			
						Age + Gender + Year
						Age difference to partner
24.66						
41.16						Lifetime unemployment
	941.39					
	786.49					High. Education obtained
		82.20				
		86.26				
		90.46				Country of origin
		89.14				

Appendix H

Test for interaction between variables

APPENDIX H. Test for interaction between variables related to the victim in the basis model.

	Lifetime unemployment		Living with partner		Socioeconomic group		Citizenship	
Interaction	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**
Gender	40.19	3	1.40	1	75.03	5	3.37	3
Age	11.51	8	75.31	3	249.63	13	17.35	9
Year	46.15	33	24.21	11	161.28	55	48.34	33
Lifetime unemployment			0.14	2	40.61	8	3.64	5
Living with partner					16.73	4	5.64	3
Socioeconomic group							59.15	12
Citizenship								

ΔLR = Change in likelihood ratio when including interaction in the model.
ΔDF = Change in degree of freedom when including interaction in the model.

PPENDIX H. Test for interaction between variables related to the family in the basis model.

	Age difference		Household cross income		Living with children		Household crowding	
Interaction	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**
Gender	10.71	1	57.15	4	135.19	2	136.10	4
Age	44.49	3	873.12	11	585.70	5	58.33	12
Year	14.14	11	97.27	44	34.57	22	62.46	44
Age difference			38.86	3	3.69	1	77.11	4
Household cross income					399.35	3	168.23	12
Living with children							21.41	4
Household crowding								

ΔLR = Change in likelihood ratio when including interaction in the model.
ΔDF = Change in degree of freedom when including interaction in the model.

APPENDIX H. Test for interaction between variables related to the family in the extended model.

	Age difference		Household cross income		Living with children		Household crowding		Lifetime unemployment$_{part}$		Socioeconomic group$_{part}$		Immigration status$_{part}$	
Interaction	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**	**ΔLR**	**ΔDF**
Gender	22.15	1	11.08	4	57.86	2	101.05	4	58.44	1	74.49	5	51.21	2
Age	42.68	3	62569	11	508.57	5	31.79	12	77.68	1	158.93	10	75.93	2
Year	11.82	12	76.12	44	33.46	22	65.55	44	35.40	11	100.39	55	41.16	22
Age difference			36.46	3	64.12	1	23.35	4	1.24	1	15.59	4	12.25	1
Household cross income					263.77	3	60.88	12	103.72	3	110.56	15	86.22	6
Living with children							22.07	4	250.71	1	245.38	4	246.83	2
Household crowding									28.63	4	76.80	20	50.15	8
Life unemployment$_{part}$											14.86	4	0.03	1
Socioeconomic group$_{part}$													25.59	4
Immigration status$_{part}$														

ΔLR = Change in likelihood ratio when including interaction in the model.

ΔDF = Change in degree of freedom when including interaction in the model.