Cecilie Therese Hagemann

Medical findings and legal outcome among postpubertal women attending the Sexual Assault Centre at St. Olavs Hospital, Trondheim, Norway

A record-based study from 1997–2010

Thesis for the degree of Philosophiae Doctor

Trondheim, October 2014

Norwegian University of Science and Technology
Faculty of Medicine
Department of Public Health and General Practice

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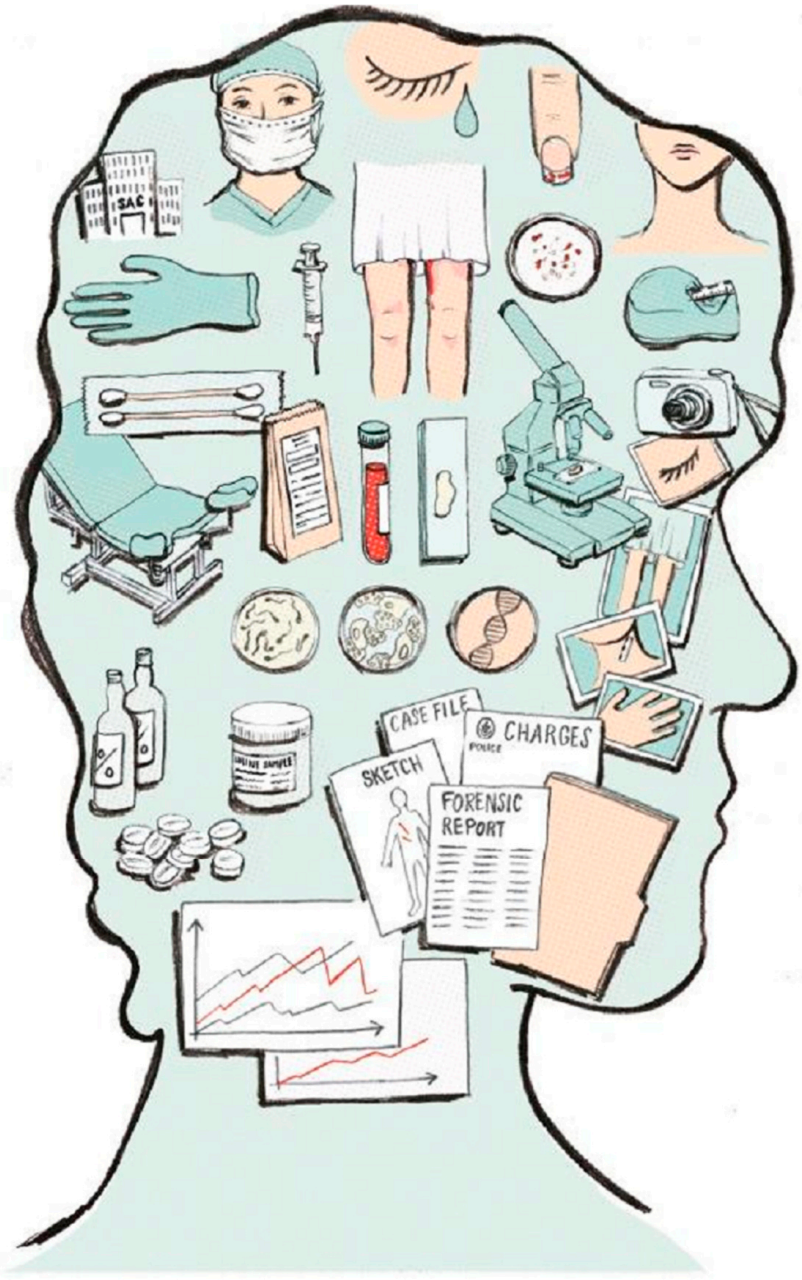

Illustration: Sylvia Stølan

Medisinske funn og rettslig utfall blant kvinner som har oppsøkt overgrepsmottaket ved St. Olavs Hospital, Trondheim, i perioden 1997 – 2010

Overgrepsmottaket ved St. Olavs Hospital i Trondheim har siden 1989 tilbudt helsehjelp og rettsmedisinsk undersøkelse til ungdom og voksne utsatt for seksuelle overgrep. Utbredelse av seksuelt overførte infeksjoner og hvilke rusmidler som kan påvises har hittil ikke vært undersøkt blant de som søker helsehjelp etter voldtekt i Norge. Det er dessuten begrenset kunnskap om politiets og rettsvesenets bruk av medisinsk informasjon i den rettslige prosessen.

Formålet med studien var å beskrive forekomsten av seksuelt overførbare infeksjoner blant kvinner som oppsøkte overgrepsmottaket, og å kartlegge om noen av disse kunne ha blitt overført under overgrepet. Vi ville også beskrive funn av rusmidler for å se om noen kunne ha vært utsatt for rusmiddelassistert voldtekt. Til slutt ville vi se på det rettslige utfallet av de anmeldte voldtektssakene, og om det fantes noen sammenheng med påvisning av skader og sæd/DNA.

Vi gjennomførte 4 studier der de involverte hadde rapportert seksuelt overgrep til politiet og/eller til overgrepsmottaket i perioden 1997 – 2010. Til sammen ble data fra mer enn 400 kvinner hentet fra sykehusjournaler og/eller fra politiets registre.

Vi fant at seksuelt overførte infeksjoner ble diagnostisert hos 9 % av pasientene. Bare i svært få tilfeller kunne vi konkludere med at smitten hadde skjedd under overgrepet, fordi det er vanskelig å skille slik infeksjon fra allerede eksisterende infeksjon. Hos 22 % av pasientene med rusprøver, mistenkte de ufrivillig påført bedøvelse. Noen få av disse kvinnene testet positivt for bedøvende midler, men vi kunne her ikke utelukke frivillig inntak. Av de som ble testet innen 12 timer, fikk 85 % påvist alkohol, og vi beregnet alkoholkonsentrasjonen i blodet rundt tidspunktet da overgrepet ble begått til gjennomsnittlig 1,9 ‰.

I mer enn halvparten av de anmeldte voldtektssakene ble saken henlagt på grunn av manglende bevis. Bare i 11 % ble det tatt ut tiltale, og da forelå det oftere sporsikringsanalyse og dokumentasjon på moderat/alvorlig skade på fornærmedes kropp.

Tilgang til rask og kvalifisert helsehjelp etter seksuelle overgrep kan sikre de utsatte helsemessig tilheling og bedre den rettslige prosessen. Både helsevesenet og politiet kan dra nytte av bedre samarbeid og utveksling av kunnskap, for i siste instans å optimalisere forholdene for ofre for seksuelle overgrep.

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List of papers

This thesis is based on the following original papers, and referred to in the text:

Paper I

Hagemann CT, Nordbø SA, Myhre AK, Ormstad K, Schei B. Sexually transmitted infections among women attending a Norwegian Sexual Assault Centre. Sex Transm Infect. 2014 Jun;90(4):283-9. Epub 2014/02/24
doi: 10.1136/sextrans-2013-051328
PMID: 24567522

Paper II

Hagemann CT, Helland A, Spigset O, Espnes KA, Ormstad K, Schei B. Ethanol and drug findings in women consulting a Sexual Assault Center – Associations with clinical characteristics and suspicions of drug-facilitated sexual assault. J Forensic Leg Med. 2013 Aug;20(6):777-84. Epub 2013/06/25
doi: 10.1016/j.jflm.2013.05.005
PMID: 23910880

Paper III

Hagemann CT, Stene LE, Myhre AK, Ormstad K, Schei B. Impact of medico-legal findings on charge filing in cases of rape in adult women. Acta Obstet Gynecol Scand. 2011 Nov;90(11):1218-24. Epub 2011/07/29
doi: 10.1111/j.1600-0412.2011.01246.x
PMID: 21793810

Abbreviations

AGW: Anogenital warts
BAC: Blood alcohol concentration
BBV: Blood borne viruses
CI: Confidence interval
CMV: Cytomegalovirus
CRF: Case report form
CT: Chlamydia trachomatis
df: degrees of freedom
DFSA: Drug-facilitated sexual assault
EA: Expanded analyses (for Paper III)
ED: Emergency department
FVU: First void urine
GUM: Genitourinary medicine
HBV: Hepatitis B virus
    Markers: HBs (surface) antigen, HBc (core) antibody
HCV: Hepatitis C virus
    Marker: HCVAb: HCV antibody
HSV: Herpes simplex virus
MG: Mycoplasma genitalium
NAAT: Nucleic acid amplification test
NG: Neisseria gonorrhoeae
OR: Odds ratio
PCR: Polymerase chain reaction
SA: Sexual assault
SAC: Sexual Assault Center
STI: Sexually transmitted infection
STD: Sexually transmitted disease
TV: Trichomonas vaginalis
WHO: World Health Organization

Summary

Background: Since 1989, the Sexual Assault Center (SAC) at St. Olavs Hospital in Trondheim, Norway has offered medical assistance and forensic examination to victims of sexual assault. The purpose of the acute medical examination is to identify and treat disease and injuries important for the victim's health. Certain findings could also be pertinent to the police investigation and possibly decisive for the legal outcome. Until now, sexually transmitted infections (STIs) and toxicological findings have not been described among Norwegian adult and adolescent sexual assault victims seeking acute medical help. There have been prior studies of police-reported rapes, but there is limited knowledge of the impact that medical information has had on legal outcome.

Objectives: Firstly, we wanted to describe the prevalence of sexually transmitted infections (STIs) among female adult and adolescent patients who visited the SAC, and to evaluate whether STIs diagnosed at the initial visit could have been assault-transmitted. Secondly, we aimed to describe which drugs were found in urine and/or blood, to further evaluate whether the test results were consistent with so-called "proactive" drug-facilitated sexual assault (DFSA). Finally, we wanted to describe the legal outcome among cases of rape and attempted rape and to explore whether extragenital and anogenital injuries and biological trace evidence had any association with the filing of criminal charges.

Methods: The studies were conducted from two different samples of women reporting sexual assault to the police and/or to a hospital SAC (1997 – 2010). Four studies were conducted. The first two studies explored STIs and toxicological findings among 412 and 264 SAC patients, respectively, using information from the hospital records only. The third and fourth study, examining the association between medical findings and legal outcome among 101 and 324 police-reported rapes, respectively, used merged data from both hospital and police records. All studies were retrospective and descriptive, but comparisons were done for the different outcome variables. We used Pearson's $\chi 2$ test, Exact Unconditional test/Fisher's Exact test, Pearson's $\chi 2$ test of heterogeneity, or Kruskal-Wallis test as appropriate. In addition, further exploration by binary and multivariable logistic regression analysis was performed.

Results: Altogether, at least one STI was diagnosed in 8.5% of the patients attending the SAC. The proportion of women diagnosed with genital chlamydia infection was notable (6.4%), but lower than in the comparable clinical population. Differentiating STI transmitted during assault from pre-existing STI is difficult, and in only two cases was the STI suspected to be assault-transmitted. Ethanol and/or drugs were detected in 59% of the SAC patients tested, including benzodiazepine-like substances in 12% of the patients. A suspicion of proactive DFSA was expressed by 22%; however, only in five patients were the detected sedative drugs not accounted for by voluntary intake. All of these five patients had a history of drug abuse/anxiety. Therefore, no cases could be unequivocally attributed to proactive DFSA. Among those tested for ethanol within 12 hours of the assault, 85% tested positive. The median estimated blood alcohol concentration at the time of the assault was 1.9 g/L. Those testing positive for ethanol more often reported a public venue, a stranger assailant, and more than one assailant. However, those testing negative for ethanol more often had another vulnerability. Criminal charges were not filed in more than 50% of the cases because of insufficient evidence. The proportion of cases taken to court was 16% in 1997 – 2003, but reduced to 8% during 2003 – 2010. The police's decision to submit trace evidence for analysis was associated with the filing of charges, and moderate/serious bodily injury was more often documented among the cases taken to court.

Conclusion: STI prevalence among SAC patients was lower than in the comparable clinical population, and only two cases of STI were probably assault-transmitted. Alcohol was the dominating drug found in urine and/or blood samples from SAC patients, and no cases of "proactive" DFSA could be unequivocally verified. Only a small proportion of police-reported rape cases were taken to court; in such cases, a higher proportion had moderate/serious bodily injury and the trace evidence was analyzed more often. Available access to immediate and qualified health care after sexual assault should ensure that victims receive valuable recreational help and that their legal rights are protected. However, both health care and the police would benefit from better cooperation and exchange of knowledge to improve outcomes for victims of sexual assault.

1 Introduction

The idea for this thesis surfaced after years of interest in the field while working as part of a sexual assault team of gynecologists, pediatricians, psychologists, and nurses. As a gynecologist working at the Sexual Assault Centre (SAC) at St. Olavs Hospital in Trondheim, Norway, I prioritized adult and adolescent women exposed to sexual assault for this thesis, although our team also treats children and men. Physicians working at the SAC need to take into account both health care and forensic perspectives when dealing with sexual assault victims, and this need for dual perspective was part of my motivation. The unique situation for the SAC patient at the intersection of medical and legal disciplines compelled me to further explore the topic.

This thesis discusses some of the medical findings documented during the clinical and forensic medical examinations of female victims of sexual assault, particularly sexually transmitted infections (STIs), drugs detected in urine and/or blood, as well as injuries and trace evidence. These topics could be of interest for the patient only, for the police investigators/prosecutors only, or for both of these groups. Some knowledge about the health consequences of sexual assault has already been established from Norwegian SAC studies. However, the Norwegian research on medical findings revealed from SACs is fragmentary and limited, at least regarding STIs and drugs. The prevalence of injuries after rape in a Norwegian context has been estimated, but the use of such information by the police, and its final consequences for legal outcomes, is not clear. The lack of research in this field stands in stark contrast to the tremendous attention given to the issue of sexual assault in the media and in political discussions.

This thesis consists of three original papers, some expanded analyses and a summarizing part. All information used in this thesis has been collected from two different record systems: medical records and police files. A substantial part of the thesis is descriptive, although comparisons have been done for different outcomes. My aim is to increase knowledge about the health care and forensic services in sexual assault cases in a Nordic context. This information could be used to improve the

quality of such health care. I want to attract attention to the legal use of data collected from SAC patients, and highlight the benefit of using medical information to investigate rape cases. While the mental or long-term health consequences after sexual assault are of great concern, these issues are beyond the scope of this thesis.

Personal background

- Authorized as a Norwegian physician in 1996
- Worked at a hospital SAC since 1997
- Courses in legal medicine 2003 – 2004
- Consultant specialist in Obstetrics and Gynecology in 2004
- Senior SAC worker/supervisor since 2004
- SAC project coordinator during 2007
- Ph.D. project on sexual assault/rape from 2009
- Have personally performed a considerable percent of the SAC examinations included in this study
- Teacher at courses in legal medicine

2 Background

In this section, some central terms will be defined, according to the World Health Organization (WHO) and to the Norwegian penal code. To assess the scope of the problem, prevalence estimates of sexual violence will be addressed in different settings: in population surveys, according to rape crime statistics, and in health care settings. Finally, the background for each of the papers will be introduced in detail, in terms of a critical exploration of the relevant literature and the body of research in the field which informed the writing of the present papers. The most extensive review of the literature regards STI and sexual assault, as there is a lack of recent overviews on this topic.

2.1 Sexual violence, sexual assault, and rape

2.1.1 Sexual violence according to the World Health Organization

Sexual violence is ubiquitous, affects all social classes (1), and is classified by the WHO as a major public health problem (2). According to the WHO, sexual violence is defined as "any sexual act, attempts to obtain a sexual act, or acts to traffic for sexual purposes, directed against a person's sexuality using coercion, harassment or advances made by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work" (1, 3).

Sexual violence includes rape, generally defined as physically forced or otherwise coerced penetration of the vulva or anus, using the penis, other body parts, or an object. The attempt to do so is denoted as "attempted rape" (3). The term "sexual assault" usually refers to a single episode, and is often identical to rape and attempted rape. In contrast, the term "sexual abuse" is more commonly used when discussing sexual violence against children, and also when forced sexual activity is part of an abusive relationship or domestic violence. Violence, on the other hand, is the intentional use of physical force or power that either results in or has a high likelihood of resulting in physical or psychological harm (3). Health care often uses the term "sexual assault," thereby avoiding the legal term "rape," whereas the police force often uses the terms "rape" and "attempted rape." For the purpose of this thesis, the

term “sexual assault” will be used for those attending health care, and “rape”/“attempted rape” for those attending the police.

2.1.2 Rape according to the Norwegian penal code

Legal definitions of rape vary greatly in scope (1). The Norwegian Penal Code states the following (4, 5): “A person committing rape or attempted rape is defined as one who obtains sexual activity by means of violence or threats, or with any person who is unconscious or for any other reason incapable of resisting the act, or by means of violence or threats compels somebody to engage in sexual activity with another person, or to carry out similar acts with him- or herself.”

In addition to vaginal, anal and oral intercourse, touching of genitals, a man’s exposed genitals being rubbed between a woman’s thighs or buttocks, or on her belly, masturbation, licking or sucking of genitals, or insertion of fingers or objects into the vagina or anus is defined as rape (6).

The punishment for rape could be more severe if the victim contracts a sexually transmitted infection as a result of the rape (section 192, 3. paragraph, letter d). The sexual exploitation of a person's helplessness due to unconsciousness, intoxication, or sleep was in the year 2000 included in the category of rape (section 192, 1. paragraph, letter b), thereby increasing the level of punishment for such a crime (5, 6). An additional paragraph can also be used for situations when the suspect has induced a condition mentioned above to achieve sexual intercourse (section 192, 2. paragraph, letter b) (5). Attempted rape is also punishable, but covered by another paragraph in the Norwegian Penal Code (section 192, cf. section 49).

2.2 Prevalence of sexual violence, sexual assault, and rape

2.2.1 Prevalence of sexual violence in population surveys

Women and girls are more likely to be the victims of sexual violence, and men are more likely to be the assailants. In most instances, the assailant is known to the victim (1). The WHO multi-country study performed in 10 mostly middle- and low-

income countries[a] estimates that between 6 and 59% of women reported ever being subjected to sexual violence by an intimate partner and between 0.3 and 12% by a non-partner (7). Furthermore, this study reveals that between 1 and 21% of women were subjected to sexual abuse before the age of 15 years. According to the International Violence Against Women Study, 13 to 34% of women in high income countries[b] reported ever having been raped during their lifetime (8, 9). Comparable numbers from the U.S. are 18% (10, 11). In addition, a recent systematic literature review found that 7% of women aged 15 years and older worldwide had ever experienced non-partner sexual violence (12). According to this study, estimated prevalence of non-partner sexual violence was 12%, 13% and 16% for women in Western Europe[c], North America[d] and Australasia[e], respectively.

In comparison with the prevalence of rape globally, women in Norway seem to experience rape at about a similar rate as other Western countries. Recently, a national large-scale study of the prevalence of sexual violence was conducted in Norway. Among 2,435 women aged 18 to 75 years, the researchers found a lifetime prevalence of rape[f] of 9%, and half of the women who reported rape had been raped before the age of 18 years (13). In a prior Norwegian national survey of 2,143 ever-partnered women only, 10% reported being raped after the age of 15 years (14). However, the prevalence of rape in Norway is not clear, since a smaller national survey drawn from a random sample of 387 Norwegian women in 2012 found that as many as 16% had experienced unwanted sexual intercourse after the age of 16 years, and 11% at an earlier age (15). The risk of being sexually assaulted is higher among adolescents and young adults than among older women (13, 16). In all of these Norwegian studies, some men also report being subjected to sexual assault, but at much lower rates (1 – 3%) than women.

[a] Bangladesh, Brazil, Ethiopia, Japan, Namibia, Peru, Samoa, Serbia and Montenegro, Thailand, Tanzania
[b] Germany, Italy, Switzerland, Denmark, Sweden, Australia
[c] Switzerland, Spain, Isle of Man, Sweden, U.K., Denmark, Finland, Germany
[d] U.S., Canada
[e] New Zealand, Australia
[f] I.e., forceful vaginal, anal, or oral intercourse or the insertion of fingers or objects into the vagina or anus. Notably, the authors excluded in the definition of rape those sexual acts occurring when the person was intoxicated (incapacitated rape) and the touching of genitals.

Findings from the U.S. and Norway show that about 30% of raped women have been physically injured (13, 17). However, only one third of women who have been injured as a result of rape receive medical treatment (17). Injury could play a role in the decision to report. Whatsoever, it is estimated that only around 5 – 25% of victims attend acute health care and/or contact the police after sexual assault (6, 14, 16-24).

Figure 1 is a modified illustration after Schei *et al* (25) and depicts a theoretical model of assumed occurrence of sexual assault in various female populations in relation to the samples addressed in this thesis, that is, the proportion of women reporting to health care and to the police. In Norway, 55 – 66% of those contacting the police after rape receive medical care (26, 27), while a similar fraction (50 – 60%) of those contacting SACs report the sexual assault to the police (20, 28).

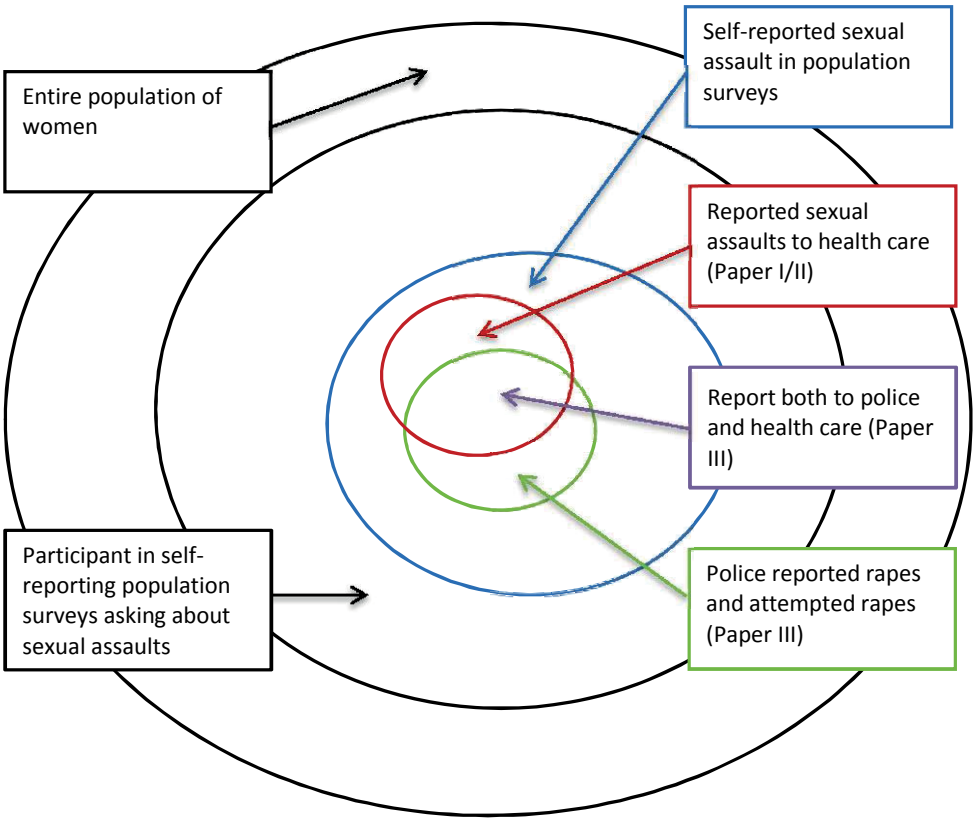

Figure 1 Theoretical model of the proportion of women from the entire population, who participate in population surveys, who report in population surveys being subjected to sexual assault, and finally, who report to health care (red) and/or to the police (green). (Not drawn to scale. Those participating in surveys are not necessarily the same as those reporting to health care/police. Modified illustration after (26))

2.2.2 Rape crime statistics

Statistics regarding rapes and attempted rapes can also be estimated by those reporting to the police. Annual national statistics can be produced using STRASAK[g], the electronic Norwegian crime register. According to a recent publication from the police, 1,233 rapes and attempted rapes were reported to the Norwegian police in 2013 (29). Figure 2 illustrates that there has been a steady increase in reported rapes from the second half of the 1990s, corresponding to an increase of 12% over the last five years (30). However, there is only a minor increase in the annual number of rapes/attempted rapes where charges have been filed in Norway throughout the period 1998 – 2011. As a result there is an increasing gap between the number of reported rapes and those proceeding to prosecution.

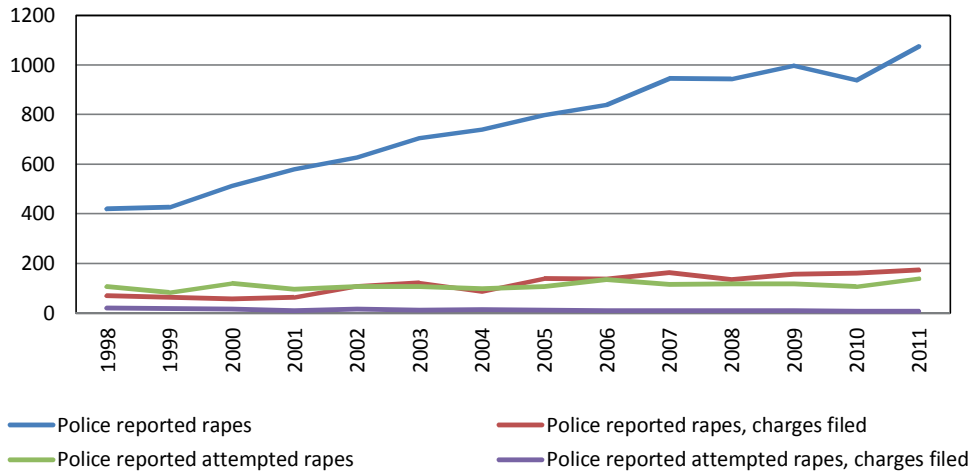

Figure 2 Annual proportion of police-reported rapes/attempted rapes where charges are filed, Norway 1998 – 2011. Source: Statistics Norway

When a rape is reported to the Norwegian police, opening an investigation is mandatory, that is so-called "public prosecution". However, during the initial briefing interview and investigation, the police and prosecuting authority may decide that no crime has been committed. These cases are not included when presenting the national

[g] Norwegian: Straffesaksregisteret

statistics of "investigated" rapes (31). In Norwegian rape cases, the final legal decisions to prosecute rape cases are made by a regional public prosecutor[h] or by the Director General of Public Prosecution[i].

Among the investigated cases, various legal outcomes are possible, see Figure 3 (31, 32). The unsolved cases are those where no suspected assailant has been identified and cases with insufficient evidence. Solved cases consist of those taken to a court of law, those where the suspect was not legally responsible[j] at the time of the crime, and those cases where charges have been withdrawn. Total national numbers of reported and investigated rapes as well as legal outcome for the period 1996 – 2011 are summarized in Table 1.

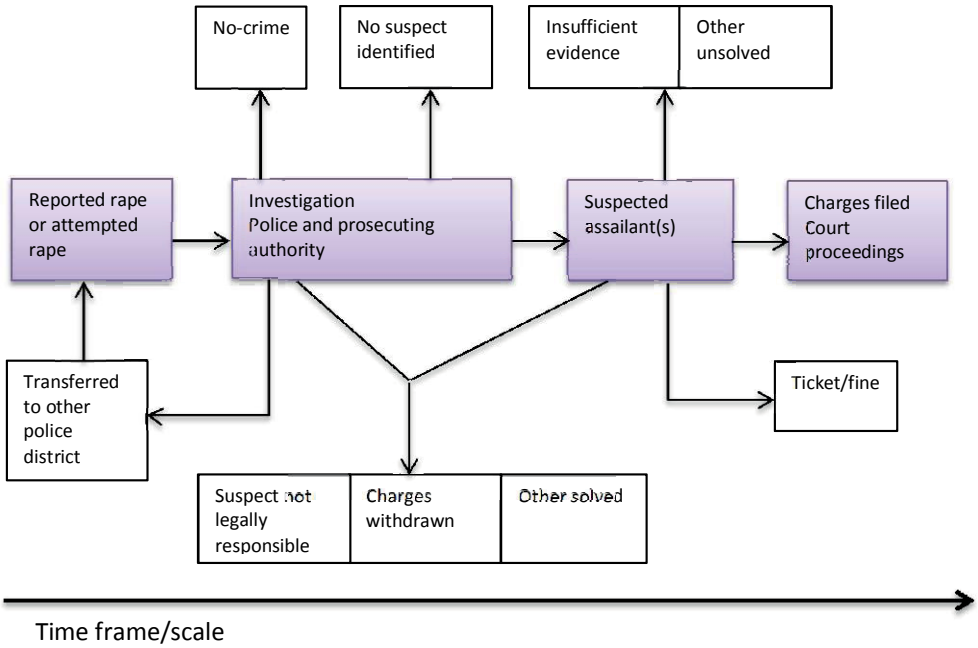

Figure 3 Illustration of course of criminal cases through the criminal justice system, from reporting to charge filing (32)

[h] Statsadvokat
[i] Riksadvokat
[j] E.g., assailant < 15 years of age

Table 1. Total national numbers of reported and investigated rapes[k] as well as legal outcome of rape cases registered for the period 1996 – 2011 (source: Statistics Norway)

Attrition	Total number of rape cases[k], N (%)
Total reported	**13,718 (100)**
Total investigated	**11,618 (85)**
Unsolved cases	**8,888 (65)**
No suspect identified	2,012 (15)
Insufficient evidence	6,803 (50)
Other unsolved	73 (0.5)
Solved cases	**2,730 (20)**
Charges filed/court proceedings	2,192 (16)
Suspect not legally responsible[j]	270 (2)
Charges withdrawn, other solved	263 (2)
Ticket/fine[l]	5 (0.04)

The legal system's treatment of rape in Norway is not unique in the region. Despite the Nordic countries' reputation as pioneers for women's rights and gender equality, a report from Amnesty International in 2008 points out the high proportion of rape cases being dismissed by the legal system in all of the Nordic countries (33). Less than one fifth of police-reported rape cases in four Nordic countries[m] ends in a conviction.

The initial police investigation following rape/attempted rape could be crucial for a case to be proceeded in a court of law, and several steps to improve investigations of rape cases have been suggested (6). One of these steps is enhanced cooperation between the police and health care, while another is using better forensic equipment (e.g., photo documentation) and increasing the competence of the medical staff.

2.2.3 Health care after sexual assault, the Sexual Assault Centers (SACs)

Before the establishment of the first SACs worldwide, the forensic management of a complainant was typically conducted in the police station when an allegation of a sexual crime was made. These situations of medical care were inappropriate, since

[k] Rapes (including indecent assault by means of threats/devious behavior and indecent assault to an unconscious subject) and attempted rapes

[l] Incl. two cases of indecent assault by means of threats/devious behavior, one case of indecent assault to an unconscious subject, and two cases of attempted rapes

[m] Denmark, Finland, Norway, and Sweden were included in this report

after the examination, the victims were obliged to seek help from several agencies in different locations. Thus, a multi-disciplinary model developed, where professionals from different fields cooperated. The first such SAC was established in the U.S. in the early 1970s, followed by those in Australia (34). In Europe, hospital-based SACs were first established in Ireland in 1985, and in the U.K. in 1986 (35). The first Nordic multidisciplinary SAC was set up in Oslo at the municipal emergency ward[n] in 1986 (36, 37), followed by the SAC established at the University Hospital of Trondheim in 1989 (19). After that, centers have been established in other Nordic countries (20, 34, 38-40), and further in other parts of the world (41-45).

Patients contacting SACs need acute medical care to ensure that short- and long-term health consequences are reduced to a minimum. The patient should be examined by trained physicians and nurses who provide both emergency medical treatment and psychosocial support and care. An evaluation of Norwegian SACs finds that these clinical issues are well taken care of (46). However, in addition to examination and prophylaxis for STIs and offering emergency contraception, a forensic examination should be performed in conjunction with the clinical evaluation.

The organization of forensic medicine in Norway requires that the examining physician may be requested to prepare a forensic report to assist in a police investigation. If summoned, he or she must act as an expert witness in court. It has therefore been important to systematize the documentation of injuries and the collection of biological trace evidence (47, 48). Forensic education for medical personnel is offered through regular national courses, but still, the forensic skills among physicians working at Norwegian SACs seem not to be prioritized. The quality of forensic documentation varies across the country's 23 SACs. It has been especially difficult to achieve high quality forensic service in the smaller SACs, which annually receive only a few patients (46, 49, 50).

Altogether, a total of 1,207 patients subjected to sexual assault contacted one of the Norwegian SACs during 2011 (51). The Trondheim SAC has experienced a steady increase in the annual number of patients attending health care after sexual assault

[n] Legevakten

(Figure 4). We do not know whether the increased attendance rate is due to a growing awareness of the available specialized health care services or to an actual increase in prevalence of sexual assault.

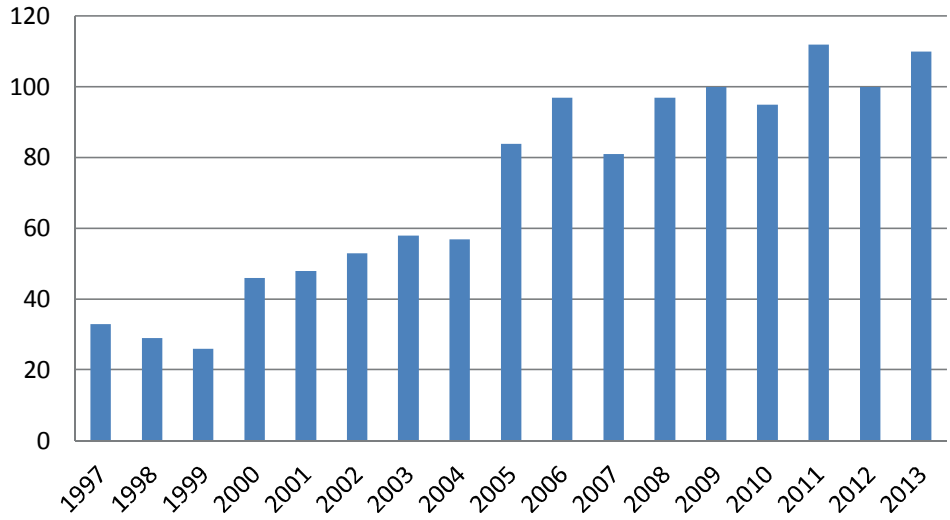

Figure 4 Annual numbers of patients attending the Trondheim SAC, 1997 – 2013

2.3 Medical findings after sexual assault

An exploration of the acute medical findings among women subjected to sexual assault is motivated by three main objectives: 1) discovering those findings important for women's health and well-being, but with no or limited legal interest; 2) tracing those findings important both for women's health and for legal interest; and 3) disclosing medico-legal findings of no relevance to the woman's health, but pertinent to the police investigation and possibly decisive for the legal outcome.

An example of the first objective is examination and prophylaxis for STIs, which are important health-wise, but not necessarily applicable as medico-legal evidence in a rape investigation[o]. The possibility of detecting drugs in urine and/or blood is important to the woman herself as well as to the police officers and prosecuting

[o] Especially in coitally experienced women

authorities, particularly in cases where drug-facilitated sexual assault is suspected. In these cases, the medical staff's descriptions of the victim's state of intoxication may be highly pertinent. Furthermore, the documentation of injuries, retrieval of spermatozoa, and recovery of a suspect's DNA from swabs collected from the victim's body could be of interest mainly to the police investigation (52-54).

As important as the medical findings may be to a police investigation, the well-being of the victim is the most crucial point at every stage of the process. Cooperation with the victim and securing her consent at any stage of examination and forensic documentation is the top priority, ranking above all investigatory and legal issues. In particular, the anogenital examination has the potential to be intrusive and traumatizing for the patient if not undertaken in a sensitive and well-prepared way.

Below, I will address three different medical areas concerning the acute medical examination of sexual assault victims. Hence, the background for the papers dealt with in this thesis will be presented in the following sections.

2.3.1 Sexually transmitted infections among rape victims

Many victims contact health care because of a fear of contracting STIs/BBVs after the sexual assault (55). In theory, the risk of transmission of STIs/BBVs during a sexual assault is dependent on the prevalence in the general population and especially among assailants, the assailant's use of a condom, the number of assailants, the sexual acts performed, whether ejaculation occurred, and finally, the presence of anogenital injuries or ulcerative lesions (especially for BBVs).

2.3.1.1 Prevalence of STIs/BBVs in SAC studies

The prevalence of STIs/BBVs among adult and adolescent female victims of sexual assault has been described in several studies. However, the most recent literature reviews are almost 15 years old (56-60), and most studies reviewed were conducted under conditions quite different from today. More sensitive diagnostic tools, such as the nucleic acid amplification test (NAAT) instead of culture, have been developed recently. The use of urine or vaginal swabs, and not only cervical swabs, has simplified collection of samples and a full genital examination is no longer

necessary for the purpose of STI detection.

Studies on STIs after sexual assault are difficult to compare. Different study designs exist, although most are retrospective without follow-up data. Differences in the victims' ages and sexes, sociodemographic factors, countries, proportions examined, and post-assault intervals vary across the studies. In the U.K., where many of the studies are conducted, the acute forensic examination is dealt with by a different health care team than the one dealing with the clinical examination and treatment for STIs[p]. Collecting samples for STI detection is sometimes thought to hamper the quality of trace evidence collection and is mostly devoid of legal interest (61-63). The diseases dealt with (some include PID, candidiasis and bacterial vaginosis, CMV[q] and pediculosis pubis) and the detection rate of the different microbes vary between the studies as different diagnostic approaches are used.

I searched for articles published after 1985 using the MeSH[r]-terms "Sex Offenses" and "Sexually Transmitted Diseases." In addition, I manually checked for citations in the reference lists of the retrieved articles. Studies dealing with children under 12 years of age and those regarding only male victims were excluded. Publications in Scandinavian and English languages were prioritized. The tables below give an overview of the literature published between 2003 and today (named "recent," Table 2) and from 1985 until 2003 (named "older," Table 3). Except for one, all studies in Table 3 are from the U.K. and the U.S. Only one Nordic study has been published, more than 15 years ago (64).

For this thesis, the following STIs and BBVs described in Table 2 and 3 will be explored: "any STI,[s]", Chlamydia trachomatis (CT), Neisseria gonorrhoeae (NG), Trichomonas vaginalis (TV), and seropositivity for HIV, hepatitis B virus (HBV), and syphilis.

The term "any STI" is reported in a number of studies. Among the most recent studies, eight report prevalence of "any STI": from 5% in a U.S. study (65), varying

[p] STD (sexually transmitted disease) clinic, also called GUM (genitourinary medicine) clinics in the U.K.
[q] Cytomegalovirus
[r] Medical Subject Headings
[s] Serologic markers for BBVs not included in this term

Table 2. Prevalence of sexually transmitted infections (STI)[t] and blood borne pathogens (BBP) among victims of sexual assault, as well as post-exposure prophylaxis offered. Overview of 13 studies published 2003 – 2012, chronologically

First author, publication year, country	Sample size, setting and, years included, design	STI prevalence, at initial visit (at presentation), No. testing positive/no. tested (%)	BBP prevalence[u] at initial visit (at presentation), No. testing positive/no. tested (%)	Post-exposure prophylaxis: antibiotics, HBV[v] vaccination, and HIV PEP (offered/ received) (%)	Sex, age, time from assault, test method, follow-up
Meel, 2011, South Africa (42)	n=1691 attending a SAC; 2001 – 2005; retrospective		HIV: 197/1435 (14%)		All female Aged 1 – 55 years
Jo, 2011, South Korea (41)	n=316 attending a hospital based service for victims of SA; 2008 – 2010; retrospective	Any STI: n=104 (33%) (CMV incl.); NG: 19/303 (6%); CT: 90/312 (29%); > 1 STI: 9/301 (3%) Positive for both CT and syphilis, n=1	HIV: 0/313; HBV: n=1 HBsAg[v] positive; syphilis: 1/316 (0.3%)		All female Mean age 23 years (± 8.7) Mean 69 h from SA Cervical PCR-test (CT, NG and CMV)
Adlington, 2011, U.K. (66)	n=65 attending an STD clinic after SA; 2005 – 2008; retrospective	Any STI: 14/63 (22%)	HIV: 0	HBV: 16/23 who came within 21 days; HIV-PEP: 2/4 who came < 72 h after assault	All but one female Median age 23 years (12 – 53) Median 26 days from SA
Ranney, 2011, Kenya (43)	n=321 attending a hospital unit; 2007 – 2008; retrospective		HIV: 7/285 (2.5%); HBV: 4/203 (2.0%); syphilis: 2/257 (0.8%)	Antibiotics: 261/311 (84%); HIV-PEP: 195/309 (63%)	94% female Median age 14 years 97% came within 72 h after SA
Gilles, 2010, Belgium (67)	n=356 attending a hospital emergency department; 2002 – 2007; retrospective	CT: 18/221 (8%)	HIV: 5/326 (1.5%); HBV: HBsAg: 6/311 (2%); HCV: 12/318 (4%); syphilis: 3/270 (1%)	Antibiotics: 144 (40%); HBV: 12 (3%); HIV-PEP: 62 (18%)	All female Median age 25 years (15 - 79) Within 2 days of assault in 85% PCR-test used (CT)
Bechtel, 2008, U.S. (65)	n=114 attending an emergency department; 2004 – 2006; retrospective	Any STI: 6/114 (5%); NG: 1/110 (1%); CT: 5/110 (5%)	HIV: 0/106; HCV: 0/102; syphilis: 0/102	Antibiotics: 88/105 (84%); HIV-PEP: 41/60 (68%)	98% female Mean age 14 years (all ≤19 years) All examined ≤ 100 h after SA Urine/swabs, PCR-test (CT/NG)

Forbes, 2008, U.K. (68)	n=69 attending an STD clinic after SA; 2006 – 2007; retrospective	NG: 1/54 (2%); CT: 5/54 (9%); TV: 1/54 (2%)	HIV: 0/28	Antibiotics: 19/45 (42%); HBV: offered if within 6 weeks of assault (n=45); HIV-PEP: n=2 (of 10 who came within 72 h)	All female Median age 26 years (16 - 53) 20% came within 7 days of assault Follow-up attending rate 40/65 (62%)
beyesekera, 2007, U.K. (69)	19 STD clinics reported on n=521 patients, of which n=134 case-notes were reviewed; 2002; retrospective	Any STI, females: 29/111 (26%); > 1 STI: 7/111 (6%)	HIV: n=110 tested (no result given)	Antibiotics: 19 %; HBV: 60 %; HIV-PEP: 3 %	N=120 female, n=14 male Median age 26 years (16 – 60) Examined < 1 – 2 weeks after assault in 36% Follow-up rate 93/120 (76%)
Ackerman, 2006, U.S. (70)	n=812 attending an emergency department after SA; 2001 – 2004; retrospective	NG: 47% tested; CT: 46% tested (no results given)	"Small numbers of positive tests" for HIV and hepatitis	Antibiotics: 696/812 (86%); HIV-PEP: 34/812 (4%)	All female Aged 15 – 80 years Examined "acutely" 36% attended for follow-up

Thompson, 2006, U.K. (71)	n=212 attending an STD clinic;
	2002 – 2004; retrospective
		Any STI: 23/209 (11%); NG: n=2 (1%);
		CT: n=19 (9%);
		genital warts: n=1;
		genital herpes: n=2;
		> 1 STI: n=1
					90% female
					Median age 21 (IQR 11)
					Median 18 days after SA

Das, 2004, U.K. (72)	n=68 attending an STD clinic; 2001 – 2002, retrospective	Any STI: 11/68 (16%); CT: 4/68 (6%); TV: 6/68 (9%); > 1 STI: 1/68 (1%)	n=51 (75%) had syphilis, HBV, HCV and HIV serology tests (no results given)	Antibiotics: 5/68 (7%); HBV: 18/20 presenting within a week	Median age 22 years (12 – 50) 29% came < 1 week after SA Follow-up: 16/20 among those who came < 1 week after SA
Kawsar, 2004, U.K. (73)	n=98 sexual assault victims referred to an STD clinic; 1996 – 2000, retrospective	Any STI: 23/88 (26%) (incl. candida and BV); NG: n=2; CT: 10/88 (11%); > 1 STI: 2/88 (2%)	HIV: 0/33; HBV: 0/57; HCV: 0/57; syphilis: 0/57	Antibiotics: 13/98 (13%); HBV: 8 (8%); HIV-PEP: 0	All females All ≤ 16 years of age, but 84% were ≥ 13 years 17% examined within 7 days n=69 (70%) were followed-up within 3 months
Kerr, 2003, U.K. (74)	n=370 SAC patients who were followed-up for "sexual health counselling"; 2000 – 2001; retrospective	Any STI: 23/211 (11%); NG: n=4 (2%); CT: n=12 (6%); TV: n=6 (3%); genital warts, n=1 (0.5%)	HBV-markers: n=1 (0,5%); syphilis: n=1 (0,5%)	Antibiotics: 47 (7%); HIV-PEP: 34 (5%)	94% females Mean age 26 years (11 -66) STI-screened 6 – 10 days after SA

[t] CT: Chlamydia trachomatis; NG: Neisseria gonorrhoeae; TV: Trichomonas vaginalis; CMV: Cytomegalovirus
[u] Excluded HBsAb results (immunity)
[v] HBV: Hepatitis B; HBsAg: HBs (surface) antigen; HBc (core) antibody; HCV: Hepatitis C virus

Table 3. Prevalence of sexually transmitted infections (STI)[w] and blood borne pathogens (BBP) among victims of sexual assault, as well as post-exposure prophylaxis offered. Overview of 16 studies published 1985 – 2003, chronologically

First author, publication year, country	Sample size, setting and, years included, design	STI prevalence[x], at initial visit (at presentation), No. testing positive/no. tested (%)	BBP prevalence[y] at initial visit (at presentation), No. testing positive/no. tested (%)	Post-exposure prophylaxis: antibiotics, Hepatitis B vaccination, and HIV PEP (offered/received) (%)	Sex, age, time from assault, test method, follow-up, incl. conversion from neg. to pos. test
Gibb, 2003, U.K. (75)	n=53 attending a hospital STD service after SA; 1997 – 1999; retrospective	NG: n=0/50; CT: n=4/50 (8%); TV: n=3/50 (6%)		Antibiotics: 22/25 (88%)	All female >16 years of age All attended within 2 weeks of SA Culture (NG, CT, TV) ELISA[z] and wet film (CT and TV) Follow-up: 57% by 2 weeks, and 30% by 6 – 12 weeks
Riggs, 2000, U.S. (76)	n=1076 attending a hospital service after SA; 1992 – 1995; prospective	NG: 12/393 (3%) CT: 24/441 (5%)		Antibiotics: 88%	96% females Median age 23 years (1 – 85) Probably all acute Culture (NG) and ELISA[z] (CT)
Bottomley, 1999, U.K. (77)	n=58 attending a hospital service after SA; 1996; retrospective	Any STI: 6/41 (15%); NG: 2/41 (5%); CT: 3/41 (7%); TV: 1/41 (2%); genital warts: n=0; HSV: n=0	HBV[æ]: 1/41 (2.4%); HCV[aa]: 1/41 (2.4%) (one patient had both)	Antibiotics: 26 %	All female, except n=3 Mean age 27 years (14 – 60). STI screen advised at ≥ 3 days after SA Follow-up: 50%
Holmes, 1998, U.S. (78)	N=411 attending a SAC; 1995 – 1997; retrospective	NG: n=20 (5%); CT: n=11 (3%)	HIV: n=5 (1%); HBV: HBsAg: n=1; syphilis: n=14 (4%)	Antibiotics: 97%	All females Mean age 24 years (12 – 88) All examined acute (≤ 72 h?) Follow-up: 31% at mean 8 weeks
Worm, 1997, Denmark (64)	n=28 SAC-patients referred to a follow-up STD clinic; 1992 – 1995; retrospective	Any STI: 0/24;	HIV: 0/27; syphilis: 0/24		All female, except n=3 Median age 25 years (range 15 – 80) Mean 18 days from forensic exam to STD clinic visit Follow-up: Some had HIV-test at 3-4 months

Peipert, 1994, U.S. (79)	n=405 attending a hospital unit after SA; 1990 – 1993; retrospective	NG: 8/335 (2%); CT: 23/292 (8%)	HIV: 2/80 (3%); syphilis: 2/326 (1%)	Antibiotics: 221/399 (55%)	All female Median age 21 Median 7 – 11 h from SA
Davies, 1992, U.K. (80)	n=110 attending an STD clinic; 1987 – 1989; retrospective	Any STI: 14/110 (13%); NG: 2/110 (2%); CT: 9/110 (8%); TV: 6/110 (5%); genital warts: 2/110 (2%); HSV: 3/110 (3%); > 1 STI: 14 patients had 22 infections	"No cases of HIV, hepatitis or syphilis were detected"		All female Aged 12 – 61 years Mean 12 days (1 – 134) from SA
Rambow, 1992, U.S. (81)	n=191 attending a hospital after SA; 1983; retrospective	NG: 18/177 (10%)	Syphilis: 1/177 (0.6%) (known from before)		All female ≥ 16 years of age 96% examined within 24 h of SA Culture (NG); FTAA[ø] (syphilis) Follow-up: n=1 (of 101) **converted to a pos NG test** after 3 – 5 days; n=2 (of 55) **seroconverted** (syphilis) suggesting infection acquired at the time of assault
Glaser, 1991, U.S. (82)	n=76 attending a hospital emergency "room; 1983 – 1986; **prospective**	NG: 2/76 (3%); CT: 13/76 (17%); TV: 15/76 (20%); HSV: 0	Syphilis: 0%	Antibiotics: n=63 (83%): i.m. inj. of penicillin; oral tetracycline for 7 days (for n=7)	All postpubertal female Mean age 22 years (range 13 – 48) All within 60 h of SA Culture (CT) and serology[å] (CT) Followed-up: 76% after 2 weeks; 49% after 6 – 12 weeks **Assault transmitted CT-infection, n=9 (16%)** (positive culture and serology titer rise at follow-up)
Ross, 1991, U.K. (83)	n=43 attending an STD clinic after SA; 1987 – 1989; retrospective	Any STI: 6/43 (14%); NG: n=1 (2%); CT: n=2 (5%); TV: n=1 (2%); genital warts: n=1 (2%);	HIV: 0/25 (0%)		All female Mean age 26 years (range 16 – 63) Mean 7 weeks after SA Followed-up: 70% after 2 weeks

[w] CT: Chlamydia trachomatis; NG: Neisseria gonorrhoeae; TV: Trichomonas vaginalis; HSV: Herpes simplex virus
[x] Only urogenital tests results given
[y] Excluded HBsAb results (immunity)
[z] ELISA: Enzyme-linked immunosorbent assay
[æ] HBV: Hepatitis B; HBsAg: HBs (surface) antigen; HBc (core) antibody; HCV: Hepatitis C virus
[ø] Fluorescent treponemal antibody absorption test
[å] Chlamydial microimmunofluorescence IgM and IgG

Table 3. Prevalence of sexually transmitted infections (STI)[w] and blood borne pathogens (BBP) among victims of sexual assault, as well as post-exposure prophylaxis offered. Overview of 16 studies published 1985 – 2003, chronologically

First author, publication year, country	Sample size, setting and, years included, design	STI prevalence[x], at initial visit (at presentation), No. testing positive/no. tested (%)	BBP prevalence[y] at initial visit (at presentation), No. testing positive/no. tested (%)	Post-exposure prophylaxis: antibiotics, Hepatitis B vaccination, and HIV PEP (offered/received) (%)	Sex, age, time from assault, test method, follow-up, incl. conversion from neg. to pos. test
		HSV: n=1 (2%)			
Tucker, 1990, U.S. (84)	n=1007 attending a hospital emergency department; treated by SARS[aa] nurses; 1985 – 1989; retrospective	Any STI (syphilis. incl.): 147/919 (16%); NG: 46/191 (5%); CT: 33/465 (7%);	HIV: No routine testing; syphilis: 8/804 (1%)	Did not offer HIV-PEP	No sex and age given n=994 (99%) examined ≤ 17 h after SA
Estreich, 1990, U.K. (85)	n=124 attending an STD clinic after SA; 1986 – 1989; retrospective	Any STI: n=36 (29%); NG: n=15 (12%); CT: n=6 (5%); TV: n=15 (12%); genital warts: n=6 (5%); HSV: n=2 (2%) (unlikely to have been ass. with the rape); > 1 STI: n=18 (15%)	HIV: 1/44 (2.3%); HBV: n= 1/92 (both HBsAg and HBeAg positive); syphilis: 0/123		All female Mean age 26 years (range 16 - 45) 46% examined within 2 weeks of SA Culture (CT, NG); smears[bbcc] (NG, TV) Follow-up: 84% at mean 31 days, and 61% at mean 11 weeks n=3 women had STI on follow-up only and no intervening coitus**: CT: n=1; genital warts, n=2** n=37 of those with a neg. HBV test were re-tested at > 3 months
Lacey, 1990, U.K. (86)	n=90 presenting to a SAC following SA; 1989; retrospective	Any STI: n=13 (14%); NG: n=2 (2%); CT: n=7 (8%); TV: n=6 (7%); genital warts: n=2 (2%); > 1 STI: n=3 (3%)	Syphilis: 0 HIV: 0/6 (after 3 months)		All female Mean age 25 years (range 13 — 77) 27% within 48 h of SA Culture (CT, NG); smears[eeff] (NG, TV); serology (CT) Follow-up: n=43 (48%) after 2 weeks, n=41 (45%) after 3 months (serology)
Sturm, 1990, U.S. (87)	n=232 victims of sexual assault attending a hospital emergency department; 1987 – 1988; retrospective	Any STI: 5%; NG: 10/210 (5%); CT: 13/213 (6%); > 1 STI: 2/203 (1%)		Not offered	All female Mean age 23 years (range 3 – 94) Follow-up: n=73 (32%) at 1 week: **n=1 converted to a positive CT**-test

Jenny, 1990, U.S. (88)	n=335 attended a hospital after recent SA, n=204 were screened for STI at initial visit; 1985 – 1986; **prospective**	NG: 13/203 (6%); CT: 20/198 (10%); TV: 30/204 (8%); HSV: 4/170 (2%);	HIV: 1/123 (0.8%); syphilis: 2/199 (1.0%)	Antibiotics: 59 (29%)	All postmenarcheal female Mean age 25 years (12 – 37 years) Examined < 72 h after SA Follow-up: n=109 (53%) after two weeks; n=52 (26%) after 6 – 12 weeks **Conversion to positive test: NG: 3/109 (4%); CT: 1/109 (2%); TV 10/109 (12%)** None seroconverted (HSV, HIV, Syphilis) at follow-up
Tintinally, 1985, U.S. (89)	n=372 attending a hospital emergency department; 1980; retrospective	NG: 5%	Syphilis: 2% (VDRL)	Antibiotics: 92 %	All female Mean age 25 years (13 – 78) 79% examined ≤ 24h after SA

[aa] Sexual Assault Resource Service
[bb] Gram-stained smears collected from the urethra, cervix and/or rectum, examined for Gram-negative intracellular diplococcic (NG)
[cc] Vaginal smears suspended in saline and examined microscopically (TV)

between 11 and 26% in the U.K. studies (66, 69, 71-74) and as many as 33% in the study from South Korea (41). Among the older studies, the one from Denmark did not disclose any STIs at all (64), while seven of the other older studies found a prevalence of "any STI" between 5 and 29% (77, 80, 83-87).

One of the most common STIs worldwide is due to CT. No recent Nordic SAC study has been published on the prevalence of CT, except for one from the Copenhagen SAC presented at a conference in 2008. In that study, 10% tested positive for CT (90). Among the recent publications (Table 2), the CT prevalence varies from 5% in a U.S. study (65), through 6 – 11% in the U.K. and Belgian studies (67, 68, 71-74), to as high as 29% in the South Korean study (41). Older SAC studies show a CT prevalence of 5 – 8% in the U.K. (75, 77, 80, 83, 85, 86), and as high as 10 – 17% prevalence in two of the U.S. studies (82, 88).

Because the NG and TV microbes were more prevalent in the U.K. and U.S. during the 1980s and 1990s than currently, most of the SAC studies presented in Tables 2 and 3 give numbers of positive tests for these STIs. Of the recent studies, those from the U.K. and the U.S. report 1 – 2% of patients testing positive for NG (65, 68, 71, 73, 74), while the study from South Korea reports 6% (41). Only two of these studies describe the diagnostic tools used. The one from South Korea and one of the U.S. studies both used PCR-diagnostics (41, 65). Many of the older studies report a NG prevalence of 5 – 12%, and even if not always stated, probably all were diagnosed by the less sensitive culture test (77, 78, 81, 84, 85, 87-89). Among the recent SAC studies, only three, all from the U.K., report TV-prevalence, between 2 and 9% (68, 72, 74), while two of the older studies report as many as 12 – 20% being infected with the microbe (82, 85).

Of great concern for many victims of sexual assault worldwide is the fear of contracting a BBV infection, especially HIV. Among the recent SAC studies, eight report HIV prevalence ranging from mostly 0 (41, 65, 66, 68, 73) through 1.5 – 2.5% in Kenya and Belgium (43, 67) to as high as 14% among South African SAC patients (42). However, in the older studies, testing for HIV was less common and reported in only seven studies with results between 0 and 3% (64, 78-80, 83, 85, 88). Prevalence of HBV

markers was low in all studies, although the definition of HBV markers was not always specified. Of the markers, hepatitis B surface antigen (HBsAg[33]) was most frequently reported. In the recent studies, less than one percent of all SAC patients tested positive for HBV markers in the U.K., the U.S. and even in South Korea (41, 70, 73, 74). In the Belgian and Kenyan SACs, 2% tested positive for HBV markers, respectively (43, 67), the former reporting a high proportion of non-Western patients. Four of the older studies report similar low numbers of patients with HBV markers (77, 78, 80, 85). Finally, syphilis was found in ≤ 1% in six of the recent SAC studies (41, 43, 65, 67, 73, 74), while almost all the older SAC studies reported on prevalence of positive test for syphilis of up to 4% (64, 78-82, 84-86, 88, 89).

2.3.1.2 Post-exposure prophylaxis (PEP)

Most Nordic SACs offer antibiotics and anti-viral prophylaxis following a sexual assault. For those SAC studies reporting STI/BBV prevalence, the proportions of SACs which offered such prophylaxis are shown in Tables 2 and 3. According to the recent studies, only 7 – 42% of the U.K. and Belgium SACs offered prophylactic antibiotics (67-69, 72-74), while 84 – 86% offered such treatment in the U.S. and the Kenyan SACs (43, 65, 70).

Whether anti-viral prophylaxis was offered to victims depends on when they sought health care. Hepatitis B prophylaxis was offered to only those who presented to a SAC up to 6 weeks after the sexual assault, and only to 3 – 70% of those victims (Table 2) (66-69, 72, 73). Anti-HIV PEP was offered to a proportion of those attending SACs within 72 hours of the assault, to between 0 and 68% of the victims. Again, the lowest numbers are reported in the U.K., and the highest numbers in one of the U.S. and the Kenyan studies (43, 65-70, 72-74).

Some SAC studies do not report STI prevalence, but instead describe the use of post-exposure prophylaxis. In a Danish SAC[34], only 26% were offered antibiotic prophylaxis in the year 2000 (20), while this had increased to 70% in the period from

[33] HBsAg indicates current hepatitis B infection
[34] At the Rigshospitalet, Copenhagen

2001 – 2005 for the same SAC (90). According to a U.S. study, 77% were offered antibiotic prophylaxis and 19% HIV prophylaxis (91). In a Brazilian SAC, 87% were offered antibiotics, 83% HBV-vaccine and a further 84% HIV-PEP (45), probably reflecting a greater fear than in Western countries of contracting BBVs after a sexual assault. In an Israeli study, all victims were offered antibiotics, and 40% were offered anti-HBV treatment, but HIV-PEP was given to only 14% (44). In Canada, even if offered and initiated, only 34% of adolescent rape victims completed the 4-weeks course of the HIV-PEP (92).

2.3.1.3 Assault-transmitted STI/BBV

Some studies have tried to deduce whether STIs detected following a sexual assault could have been assault-transmitted. Such a conclusion can easily be justified for patients with no previous coital experience. Even if an STI is diagnosed at the initial visit shortly after a sexual assault, low levels of the microbe might be detected if infected semen is caught in the swab (93). This has been found to be the case for 1 – 4% of the total group of SAC patients (Table 2 and 3) (41, 73, 82, 85).

Although most studies report that victims' recent consensual coital activity makes it impossible to attribute the infection to the assault (41, 66, 71, 94), it is important to emphasize that patients with previous coital experience can catch assault-transmitted infections. We have found one study describing a case of assault-transmitted genital herpes (71). Another study reported that two patients were found to have an STI and had not been sexually active within the 3 months prior to the sexual assault (86), thereby suggesting assault-related transmission, but this could be harder to prove.

Only two of the studies in Tables 2 and 3 are prospective, both U.S. studies which collected information as far back as the mid-1980s. These studies included follow-up visits. Jenny, *et al*, defined an STI as assault-transmitted if it was detected at the follow-up visit, but not at the initial visit, and no treatment with targeted antimicrobial agents had been given in between visits (88). A total of 14 STIs were found on follow-up tests and suspected to be assault-transmitted: one patient had CT, three had NG,

and ten had TV. However, excluding new transmission of an STI from intervening consensual coital activity might still be difficult. Glaser, *et al*, used a different diagnostic tool which is no longer in use: CT culture combined with a rise in the "titre" of CT antibodies. Together with a history of no other recent sexual activity, this was interpreted as assault-transmitted CT infection, and nine patients qualified for this description in the follow-up period (82). In the same study, the researchers assumed that five other patients contracted TV infection during their assaults. Although retrospective, two other studies each described a case of CT infection detected at the follow-up only (85, 87). However, only one of these studies had information on intervening coitus (85).

Among the older studies reporting from a period in which syphilis was more common, none of the patients who were initially seronegative for syphilis had a positive test at the follow-up visit (78, 82, 88). Only four studies reported follow-up of as long as 3 months (64, 68, 78, 88), but even within this timeframe, a few patients (0 – 2%) seroconverted to HIV positive. Contracting HIV or hepatitis B after a sexual assault has also been described in case reports (95, 96).

With this thesis, I want to deepen this prior research by adding new information about the prevalence of STIs in patients attending a Norwegian SAC, and by discussing the proportion of these STIs that could be assault-transmitted. Even if our SAC is police-independent, assault-transmitted STI could be of legal interest in selected cases.

2.3.2 Toxicological findings – Drug-facilitated sexual assault (DFSA)

A substantial proportion of women contacting SACs or the police claim to have been involuntarily drugged and sexually assaulted, or sexually assaulted while asleep or in a state that rendered them unable to consent or resist (23, 26, 97-101). Sometimes the woman does not remember or know exactly what has happened, but may have a vague feeling of genital discomfort or may have woken up in a disheveled state and missing her underwear. Others may have told her about her participation in sexual activity, or shown her explicit images or video recordings. Some of these

patients may have been subjected to involuntary drugging[35] with medicinal or illicit drugs (so-called "date rape drugs") followed by sexual assault. For decades, it has been known that certain fast-acting color-, odor-, and tasteless drugs can be added to drinks, inducing a hypnotic condition, loss of memory, and impaired motor activity and judgment, and therefore facilitating lack of resistance to sexual activity. Unfortunately, most of these substances have a short biological half-life.

2.3.2.1 Definition of DFSA

A comprehensive definition of drug-facilitated sexual assault (DFSA) was given during Operation Matisse in the U.K., when the Association of Chief Police Officers cooperated with the Forensic Science Service and the Sexual Assault Referral Centers (SARCs) in 2006. This work divided the phenomenon into two categories, denoted "proactive" and "opportunistic" DFSA (102). The former is defined as deliberate surreptitious drugging, i.e., covert administration of drug(s) to an unsuspecting victim, as described above. The latter category includes taking advantage of someone already inebriated or intoxicated by voluntary ingestion of drugs or alcohol. A situation including both of these conditions is also possible, with the victim being intoxicated because of both voluntary and involuntary ingestion of drugs (103). In all of these cases, valid consent to sexual activity is precluded. In this thesis, I use the terms "proactive" and "opportunistic" DFSA as described above.

2.3.2.2 Prevalence of DFSA

Studies describing the proportion of assaulted victims who suspect proactive DFSA are usually either surveys of the entire female population or information collected from the police or SACs. These studies often include information on self-reported intake. An example is a population-based survey among more than 5,000 female college students in the U.S., reporting that 15% of those exposed to sexual assault during the past year suspected proactive DFSA (104). An additional 57% reported voluntary intake of alcohol and drugs before the assault (opportunistic DFSA).

[35] Also called "chemical submission" or spiking

Western SAC studies report that between 12 and 26% of patients suspect proactive DFSA (23, 97-99), and the prevalence seems to be increasing (19, 97, 100). Furthermore, the proportion of victims attending SACs or the police after sexual assault and reporting intake of alcohol before the assault is 47 – 77% (26, 97, 98, 105-109) and, for illicit drugs, 9 – 20% (26, 98, 107). However, only three of these studies included results of toxicological analyses.

2.3.2.3 Prevalence of alcohol/drug findings in DFSA laboratory studies

Toxicological test results of urine/blood samples collected from rape victims are often published from forensic laboratories, but sometimes also originate from SAC or police records. Most sexual assaults included in these studies are police-reported.

A comprehensive review of the literature regarding the toxicological findings of drugs and alcohol in DFSA cases (110) includes 11 studies from Western countries (the U.S., France and the U.K.) published between 1996 and 2005 (111-121). After 2005, we have found nine similar studies, again all Western, but from a broader group of countries (105, 106, 122-128), presenting toxicological laboratory test results among sexual assault victims. We chose not to present studies including other crimes, such as robbery or murder (129). The results of studies published after 2005 are presented in Table 4, modified after Beynon, *et al* (110).

The toxicological studies differ in many directions. Firstly, the indication for testing varies. Many of the studies published before 2005 were initiated from toxicological laboratories, and included only victims suspecting proactive DFSA (111, 114, 117, 118, 121). However, in some of the early U.S. studies, sexual assault victims were screened "when drug use was suspected to be involved" and "at the examiner's discretion" (113, 115, 116, 119). Again, in the three Nordic studies, a rather unselected proportion of SAC/police-reported sexual assault victims were tested (106, 124, 127).

Secondly, test material varies across the studies. In most of the 20 studies in Table 4, urine was screened for a selection of drugs (105, 111-113, 115-128), with or without the addition of collected blood samples. One of the studies included blood tests only (106), which diminishes the time window for the detection of substances

Table 4. Toxicological findings among victims of sexual assault and specifically in cases of drug-facilitated sexua

First author, publication year, country	Sample size, setting, years included, design	Method, time from assault	Number and/or percentage of the sample where eac	
			Illicit	**Sedatives**
Birkler, 2012, Denmark (106)	n=167sexual assault victims recruited from a SAC (i.e, 63% of all the SAC victims); 2007 –2009; prospective	Blood only. Median time from sexual assault7 h (mean 13)	Illicit drugs in 7%	Benzodiazepines 10%; opioids 1%
Jones, 2012, Sweden (127)	n=1460 female police reported sexual assault victims; from a national forensic toxicology laboratory; 2008 – 2010; retrospective	Urine and/or blood. No info on time from SA	Cannabis 6%; amphetamines 4%	Benzodiazepines > 6%: diazepam 6%; alprazolam 2%; zopiclone 2%. Opioids 1%. Anti-depressants 2%
Bosman, 2011, The Netherlands (126)	N=135 DFSA cases (94% women), data from police files and a national Forensic Institute; 2004 – 2006; retrospective	Urine and/or blood 42%; urine only 37%; blood only 21%. Time from SA: < 12 h 40%; 12 – 24 h 21%; > 24 h 22%; unknown 17%	Cocaine 14%; MDMA 10%, cannabis 10%, amphetamines 4%	Benzodiazepines 10% (incl. flunitrazepam 1%); zolpidem 1%; codeine 1%; methadone 1%; GHB 2%; ketamine 1%
Du Mont, 2010, Canada (125)	n=178 sexual assault victims ≥ 16 years (i.e., 20% of those attending the SACs); 2005 – 2007; prospective	Urine tests only. 80% came < 24 h; all ≤ 72 h of the SA	Cannabis 34%; cocaine 21%; amphetamines 7%; MDMA 7%	Benzodiazepines > 6%: lorazepam 6%; flunitrazepam 0%. Anti-depressants 7%. GHB 1%. ketamine 1%
Hall, 2008, Northern Ireland (123)	n=294 police reported DFSA cases (i.e., 28% of all police reported rapes); toxicological tests at a national Forensic Service; 1999 – 2005; retrospective	Urine and/or blood. No info on time from SA	Cannabis 8%; central stimulants 3%	Analgesics 13% (of these opioids 10%); benzodiazepines 11%; anti-depressants 4%

[36] BAC (blood alcohol concentration) in g/L (‰), mean and range [ ] or SD (standard deviation) given

assault (DFSA). Overview of nine studies published after 2005 (modified after (110))

drug was detected			Voluntary intake vs. findings, strength and limitations
	Alcohol, BAC[36] at assault	**Other**	
	Alcohol 35%	At least one drug in 50%: alcohol only in 29%; alcohol + other drug(s) in 7%; other drug(s) only in 14% (Non-sedative drugs in 6%)	In 20% (4 out of 20) sedative drugs were detected, which were not reported (taken voluntarily) by the victim Strengths: Active inclusion into study. Control group of non-DFSAs. Information on intake and suspicion of DFSA. Limitations: Only those who agreed to participate in the study. Small sample size. Only blood tests included. Includes non-sedative prescription drugs in the analyses
	Alcohol 54%. Mean BAC at time of sampling 1.2	At least one drug in 68%: alcohol only 41%; alcohol + other drug(s) 13%; other drug(s) only 14%	Strength: Large sample size Limitations: No information on voluntary intake. Retrospective
	Alcohol 38%. Mean BAC at time of sampling 1.2 ± 0.07; mean BAC at time of assault 2.0 ± 0.07	At least one drug in 73%: alcohol only in 19%; alcohol and drug(s) in 19%; drug(s) only in 35% (Non-sedative drugs in > 20%)	Strengths: Includes details of alcohol/drug combinations case-wise Limitations: No information on voluntary intake. Retrospective. Small sample size. Includes non-sedative prescription drugs in the analyses
	Alcohol 31%	At least one drug in 76%: alcohol only in 13%; alcohol and drug(s) in 18%; other drug(s) only 45%	In 49% drugs were detected, which were not reported voluntarily ingested by the victim Strengths: Well defined definition of DFSA, study group, and flow chart. Information on voluntary intake, and time from assault. Prospective inclusion. Limitations: Urine only. Small sample size.
	Alcohol 56%. Mean BAC at time of assault 2.0 [1.0 – 4.1] estimated among those sampled within 12 h	At least one drug in 69%: alcohol only in 34%; alcohol + other drug(s) in 18%; other drug(s) only 13%	Limitations: No information about self-reported intake. Retrospective. Includes non-sedative prescription drugs in the analyses

Table 4. Toxicological findings among victims of sexual assault and specifically in cases of drug-facilitated sexua

First author, publication year, country	Sample size, setting, years included, design	Method, time from assault	Number and/or percentage of the sample where eac	
			Illicit	**Sedatives**
Jones, 2008, Sweden (124)	n=1806 police reported alleged female SA, examined at a national forensic toxicology laboratory, 2003 – 2007; retrospective	Urine and/or blood 79%; urine only 9%; blood only 12%. No info on time from SA	Cannabis 6%; amphetamines 5%; ecstasy < 1%; heroin metabolites < 1%; cocaine < 1%	Benzodiazepines 8%: diazepam 5%; flunitrazepam 1%; zopiclone 2%; codeine 2%; GHB < 1%; other pharmaceuticals 12%
Juhascik, 2007, U.S. (122)	N=144 sexual assault patients (i.e, 17% of those attending the SACs), cases of "DFSA" defined as "those with a positive toxicological test <72 h"; patients from SAC records; 2002 – 2004; prospective	Urine. Time from sexual assault mostly < 72 h (2 – 456 h]	Cannabis 33%; cocaine 18%; amphetamines 7%	Opioids 7%; benzodiazepines 3% (incl. flunitrazepam in > 1%)
Hurley, 2006, Australia (105)	n=76 DFSA cases (i.e., 18% of police reported adult SA); data from files of an Institute of Forensic Medicine; 2002 – 2003; retrospective	Urine and blood if < 24 h after SA, urine only if > 24 h. Median time from sexual assault 20 h (2 – 106 h)	Among those not reporting intake, n=15: cannabis n=4; amphetamines n=4 Among those reporting intake, n=20: ≥ 1 "recreational drug" found in all but 3 cases	Among those not reporting intake, n=15: diazepam, n=4; opioids n=4; antidepressants n=5; antipsychotics n=1 Among those reporting intake, n=26: "prescription medications" found in all but one case
Read, 2005, U.S. (128)	n=464 sexual assault victims (i.e. 45% of police-reported rapes); data from female patients' records; 1997 – 1999; retrospective	Urine and blood. No info of time from SA	Cocaine 28%; cannabis 12%; "other[37]" 6%	Opiates 15%

[37] "Other": phencyclidine, barbiturates, amphetamines, benzodiazepines

assault (DFSA). Overview of nine studies published after 2005 (modified after (110))

drug was detected			Voluntary intake vs. findings, strength and limitations
	Alcohol, BAC[36] at assault	**Other**	
	Alcohol 55% Mean BAC at time of sampling 1.2 [0.1 – 3.7]; mean estimated BAC at time of assault 2.0 [1.7 – 2.5]	At least one drug in 69%: alcohol only in 43%; alcohol + other drug(s) in 12%; other drug(s) only in 15%	Strength: Large sample size Limitations: No info regarding proactive DFSA suspicion, no information regarding voluntary intake; only assumed interval from sexual assault to ≈ 5 h; retrospective
	Alcohol 10%	At least one drug in 43% Positive for more than one drug 30%	Several cases (no exact proportion given) had drugs detected, which were not reported voluntarily ingested by the victim Strengths: Relates findings to self-reported intake, prospective study inclusion. Limitations: Small sample size
	Alcohol 37%. Mean BAC at time of sampling 1.1; mean estimated BAC at time of assault 2.6 [2.2 – 3.3]		In 20% drugs were detected, which were not reported voluntarily ingested by the victim Strengths: gives results according to reported intake Limitations: Retrospective chart review. Small sample size. Restricted to unexpected findings
	Alcohol 23%	At least one drug in 53%: alcohol only in 12%; alcohol + other drug(s) in 11%; other drug(s) only 30%	Strengths: contains patient and assault characteristics Limitations: no information about self-reported intake or DFSA suspicion. Retrospective.

and decreases the number of positive tests compared to urinary testing (130). On the other hand, adding a blood test yields an opportunity to relate the drug concentration to the clinical status, as done in two of the early studies (111, 118) and in six of those published after 2005 (105, 123, 124, 126-128).

Biological specimens for toxicological analyses should be collected as soon as possible after a suspected assault, since detection times for the different drugs vary considerably and for some are very short (131), see Table 5. Thus, a toxicological test may turn out to be a false negative after an interval of > 12 hours in certain cases, for example, after alcohol or gamma-hydroxybutyric acid (GHB) ingestion. In almost all previous U.S. studies (112, 113, 115, 116, 119, 121), and in one French study (117), 90 – 100% of the samples were collected within 72 hours. In more recent studies, most or all of the patients attended the SAC within 72 hours – see the U.S. and the Canadian studies, respectively (122, 125) – and 61% attended within 24 hours in the Dutch study (126). The post-assault interval was given as a median (7 and 20 hours) in two other studies (105, 106). However, in four studies, the post-assault interval was not mentioned (123, 124, 127, 128).

Table 5. Time limits for detection of drug in urine (modified from (131) and (103))

Drug	Time detectable[38]
Alcohol	7 – 12 hours
GHB[39]	7 – 12 hours
Diazepam	14 – 21 days[40]
Other benzodiazepines (flunitrazepam, oxazepam, clonazepam, nitrazepam, alprazolam)	3 – 7 days
Z-hypnotics (zopiclone, zolpidem[41])	12 – 24 hours
Cannabis (THC)	3 – 40 days[42]
Opiates/opioids (morphine, codeine, oxycodone, methadone, heroin)	2 – 5 days
Amphetamines (and methamphetamines)	2 – 9 days
Ecstasy (MDMA[43], MDA[44])	2 – 3 days
Cocaine	2 – 5 days

[38] There is considerable individual variation in the persistence of these substances in urine
[39] Gamma-hydroxybutyric acid
[40] Detected as the metabolites desmethyldiazepam and oxazepam
[41] Following therapeutic doses: for zolpidem: 12 hours, and for zopiclone: 24 hours
[42] After regular use of cannabis, THC is sometimes detected at low concentrations several months after last intake
[43] MDMA=3,4-methylenedioxymethamphetamine
[44] MDA=3,4-methylenedioxyamphetamine

Several different drugs were detected across the studies, as shown in Table 4. In older studies reporting the proportion of positive tests for at least one drug, including ethanol, the range varied from 59 to 69% of victims in the U.S. and the U.K. studies (113, 115, 116, 118-121), to as high as 77 – 83%, mostly for benzodiazepines in the selected French series (111, 117). Among the more recent studies, 43 – 53% of the victims tested positive in two U.S. studies and one Danish study (106, 122, 128), the lower numbers probably reflecting the more unselected material in one of the U.S. studies (128), and a relatively low proportion of positive ethanol tests in the two others (106, 122). This again might be caused by a long interval between the assault and the test, and by blood only being used for the analyses. In the remaining recent studies reporting total numbers of positive tests, 68 – 76% of victims of sexual assault tested positive for at least one drug (123-127).

Regarding drugs other than ethanol, prevalence vary according to country, and hence the proportion of illicit drugs in the community, and the number and type of drugs screened for. The proportion of positive tests for drugs other than ethanol in the Nordic toxicological studies ranged from 21 to 27% of victims (106, 124, 127), while 31% were drug positive in a series from Northern Ireland (123). The Dutch laboratory study found that a total of 54% of victims tested positive for at least one drug other than ethanol, although a considerable proportion of the detected drugs were non-sedative medicinal drugs assumed not relevant in DFSA cases (126). In the most recent U.S. and Canadian studies, up to 63% of victims tested positive for drugs other than ethanol; illicit drugs not typically considered “date rape drugs” (e.g., cannabis and cocaine) were detected in about one third of the cases (122, 125, 128). Similar high proportions of illicit drugs were found also in some of the older U.S., French, and U.K. studies (113-116, 118-121), probably reflecting the fact that recreational drug use was and is more common there compared to in the Nordic countries (132-134).

Benzodiazepines and related agents (zopiclone, zolpidem) are assumed to be more relevant in proactive DFSA. In two of the older French studies, positive tests for benzodiazepines dominated, since detecting such drugs was the main purpose of their toxicological analyses (111, 117). However, in most of the other studies,

benzodiazepines were found only in a minority of cases (3 – 13%), and most of those were not what we usually characterize as the classical date rape drugs (Table 4) (105, 106, 113-116, 118, 119, 121-128).

Several studies have screened for "typical" date rape drugs, that is, flunitrazepam and GHB. Flunitrazepam was only detected in 0 – 1% of the cases in the 15 studies reporting it (105, 106, 112, 113, 115, 116, 118, 119, 121-127), while GHB was found in 0 – 4% of the subjects, with the highest proportions in the older U.S. studies (105, 113, 115, 116, 118, 119, 121, 123-127). In another British study of 120 police-reported rapes, flunitrazepam was detected in no cases, but GHB was found in two (102). The newer, rapidly metabolized sedative drugs, such as the z-hypnotics – zolpidem and zopiclone – were present in only 0 – 2% of the subjects in studies published after 2004 (118, 122, 124, 126, 127).

2.3.2.4 Suspicion of proactive DFSA compared to voluntary intake

Of the 20 toxicological studies, only five (105, 106, 118, 122, 125) contain information about victim-reported voluntary intake of alcohol and/or drugs before the assault, and exclude such intake from their interpretations. In the only large-scale case series of police-investigated rapes, the U.K. authors concluded that only 2% of victims had been subjected to proactive DFSA with sedating or disinhibiting drugs, mostly benzodiazepines (not flunitrazepam), but also zopiclone, antihistamines, antidepressants, GHB and ecstasy (118). In an Australian retrospective study, 20% of the positive drug findings were unexpected (benzodiazepines, excluding flunitrazepam; opioids; antidepressants; cannabis; and amphetamines) (105). However, voluntary use of prescription medication and recreational drugs was missing in these studies in as many as 46 and 63% of the subjects, respectively. The U.S. prospective study presented some of the cases classified as DFSA, but even if impairment caused by the drugs detected in these victims was obvious, only one of the patients actually seemed to be surreptitiously drugged by oxazepam and an antihistamine. The authors claimed that self-reported intake of drugs was unreliable (122). In the prospective Canadian study, in as many as 49% of those suspecting proactive DFSA, unexpected findings

were not attributable to self-reported voluntary ingestion (125). Once again, however, the most frequent unexpected findings were not the typical date rape drugs, but illicit drugs like cannabinoids, cocaine, and amphetamines, whereas benzodiazepines, ketamine and GHB were seldom seen. Finally, the recent Danish prospective study reports that among 20 patients suspecting proactive DFSA, four had a positive blood test for one or more sedative drug (benzodiazepines, but not flunitrazepam, a barbiturate, and oxycodone) not reported to be taken voluntarily, and might thus have been drugged prior to the assault (106). Further substantiation of the suspected drugging in a court of law was not described in any of these studies, and these cases may be difficult to prosecute even when a drug test actually turns out positive.

2.3.2.5 Blood ethanol concentration in DFSA cases

Positive tests for ethanol have been described in almost all the above-mentioned studies (105, 106, 113-116, 118, 119, 121-128), and for the U.K. study, even reported in detail in a separate publication (135). Between 10 and 56% of those tested were positive for ethanol. A discrepancy between the proportion of victims reporting voluntary intake of alcohol and the proportion testing positive is common, mostly because of a long post-assault interval (105, 106, 125). Mean blood alcohol concentrations (BAC) at the time of sampling are usually high, between 1.1 and 1.2 g/L (105, 124, 126, 127). Even more important is the back-calculated mean BAC at the time of the assault, which was estimated to be between 2.0 and 2.6 g/L in four studies (105, 123, 124, 126), and in the U.K. study, 74% of those testing positive for ethanol within 12 hours of the assault had an estimated BAC of > 1.5 g/L at the time of the assault (135). The authors of the latter study claimed that such a degree of inebriation in itself would render the victim unable to give valid consent to sex, a statement that could be used as legal evidence of opportunistic DFSA. Similar high ethanol levels were also described in the smaller British crime study (102).

2.3.2.6 Associations between ethanol/drug findings and certain characteristics

A few studies have investigated which characteristics are associated with positive

tests for alcohol and/or drugs among victims of sexual assault.

The Swedish authors demonstrated that mean BAC at time of sampling differed between age groups, specifically, an increased BAC was seen with increased age (124, 127). Different kinds of drug findings have also been described for the different age groups. Those testing positive for ethanol, the antidepressant fluoxetine, and/or cannabis were younger (mean 23 – 25 years) than those testing positive for codeine, zopiclone, and/or amphetamine (mean 34 – 39 years) (127). In a U.S. study, the likelihood of testing positive for alcohol and/or drugs increased with age (128). The drug most often found among those 13 – 16 years old was cannabis (16%), while half of the subjects aged 31 – 50 years tested positive for cocaine.

During the period from 2003 to 2010, the annual number of toxicological analyses in rape cases increased in Sweden (127), but the proportion of victims testing positive for ethanol and/or drugs and the mean BAC remained stable. This is in contrast to results from Northern Ireland, where the proportion of victims testing positive for alcohol and/or drugs rose during the period from 1999 to 2005 (123).

In a U.S. study, a positive test for ethanol was most common among those assaulted at a friend's home, while those testing positive for other drug(s) were usually assaulted while walking; 58% of the drug-positive victims were assaulted by a stranger (128). In addition, those testing positive for drugs more often had extragenital injuries.

2.3.3 Extragenital injuries, anogenital injuries, and trace evidence

In Western countries, most injuries in women exposed to sexual assault are fortunately minor and of limited relevance to the woman's health. However, even minor injuries can be crucial in some cases for a police investigation and decisive to a legal outcome. Collecting such medico-legal evidence is sometimes problematic. The search has the potential to be harmful since it requires the assaulted woman to endure an "unnecessary" gynecological examination.

Also, even if medico-legal evidence is used to some degree by the police and prosecuting authorities in cases of rape, the weight of this contribution to the evidence in the progression of rape cases through the legal system is unclear (136). A global

literature review of the impact of medico-legal evidence in sexual assault cases was conducted in 2007 (52) and included 12 papers to map associations between particular types of medico-legal findings (e.g., injuries or sperm) and legal outcomes (e.g., charge filing or conviction) in adolescent and adult sexual assault cases (19, 81, 89, 137-145). Nine of these studies were from North America and another three from the Nordic countries, albeit the latter three dating back from more than 20 years. After the publication of the review in 2007, four papers with a similar scope have been published: three European and one South-African (99, 136, 146, 147). All 16 studies were retrospective and many with limited sample sizes. Below is a modified table (Table 6) with an overview of three of the studies published after 2007, in accordance with Table 4.1 in the global review (52). The fourth study will be presented in the Discussion section.

2.3.3.1 Legal outcome in rape cases

Although these 16 studies looked at different legal outcomes, three levels of legal prosecution can be identified in most of them and the studies document considerable attrition of cases through these three levels. In summary, a suspect was arrested in 34 – 45% of the police-reported rape cases (136, 138, 142), a charge was filed (trial commenced) in 11 – 55% of the cases (19, 81, 89, 136, 137, 139-141, 143-145, 147) and a conviction was reached in 3 – 29% of the cases (19, 81, 89, 99, 136, 137, 140, 145, 147).

2.3.3.2 Medico-legal findings and trace evidence analysis

The medico-legal variables studied in these 16 papers differed to some degree, but extragenital injuries were found in 23 – 90% of the rape cases (19, 81, 89, 136-144, 146); anogenital injuries in 6 – 67% of the cases (19, 81, 89, 136, 138-146); forensic samples collected by medical staff in 54 – 91% of the cases (99, 136, 143, 146); forensic kits sent to lab (by the police) in 57 – 69% of the cases (136, 146); analysis of trace evidence by the forensic lab (sperm/semen (acid phosphatase)/DNA) was performed in only 1% of cases in South Africa (136), through to 51 – 57% of cases

Table 6. Medico-legal evidence and legal outcome. Overview of three studies published after 2007, a continuation

First author, publication year, country	Sample size, setting, years included, design	Medico-legal findings[45]		
		Extragenital injury	**Anogenital injury**	**Biological samples**
Jewkes, 2009, South Africa (136)	n=951 sexual assault victims ≥ 18 years, drawn from a sample of police-reported rapes in 70 randomly selected province police stations; data from police dockets and medical examination forms; 2003; retrospective	No injury in 39%; both extragenital and genital injury 16%; extragenital (or anal) injuries in 23% (Incl. incised wounds, lacerations, grazes, bruises, and areas of tenderness)	"Genital injury with a skin tear/break" 22% (Defined as an incised wound, scratch, abrasion, or laceration, if bleeding was seen, or if scarring believed to be from the injuries caused by the rape)	Forensic kit completed 91%; forensic kit sent to lab 69%; report from forensic lab on DNA 1% (n=10): no info on sperm, DNA did not match in 5 cases
Ingemann-Hansen, 2008, Denmark (146)	n=307 female and male rape victims reported to a police department; SAC and police record data; 1999 – 2004; retrospective	Among females, extragenital injury 77%; ≥ 4 lesions 31%	Genital injuries 19%	Trace evidence sent to lab 57%; sperm seen in forensic lab 35%; positive DNA match in 15% (Sperm seen in SAC's microscope 45%)
Saint-Martin, 2007, France (99)	n=230 female and male (5%) victims ≥ 15 years of age; 66% examined within 72 h; hospital SAC; data from medico-legal reports and courtroom proceedings; 1996 – 2002; retrospective	Acute injury 45%; 85% of these bruises, most frequently to the "extremities" (here, head and hands)	Genital lesions 11%: tears in the post. forchette 6%; recent hymenal tears 10%; recent anal/rectal lesion 13% Erythema and tenderness excluded	Of those who came within 72 h, 82% had vaginal, anal and/or oral samples collected No lab report on sperm/DNA available

[45] Emotional presentation not reported in any of these studies
[46] Adjusted odds ratio
[47] Judgment for failure to prosecute the case or to introduce sufficient evidence

of studies according to Du Mont et al (52)

Legal outcome	Relationship of medico-legal evidence to legal outcome	Limitations and strength
Suspect arrested or asked to appear in court 45%; charged in court 38%; trial commenced 11%; found guilty of sex offence 3%; sentenced to imprisonment in 3%	Injuries not associated with arrest or commencing trial. Conviction more likely if injuries, whether extragenital alone (OR[46] 6.3, 95% CI 1.1 – 34), genital alone (OR[46] 7.0, 95% CI 1.4 – 34), or both extragenital and genital injury (OR[46] 12.3, 95% CI 2.9 – 53). No association between DNA and legal outcome (although DNA was more often present when trial was commenced, 5% vs 2%, p=0.06). DNA match led to acquittal in one case	Limitations: Retrospective review, the quality of medical documentation not optimal. Strengths: From a developing country, recent data, containing info on DNA matching, large sample size, possible to study association on different levels of legal outcome, broad geographic area, multivariable analyses. Study of associations presented separately for children (< 18 y) and adults.
Charges filed 55%; conviction set 19% (fines, conditioned sentences, social supervisory control, imprisonment); no suspect identified 25%; charges not filed 10%; false reports 11%; dropped before prosecution 32%	Extragenital and genital injuries not associated with conviction among the cases charged (p=0.5 and 0.3, resp.); borderline association with conviction when ≥ 4 lesions (p=0.07). Detection of sperm and victim-suspect DNA match not associated with conviction (p=0.4 and 0.3 resp.)	Limitations: Retrospective, single jurisdiction, small sample size when study of association with conviction among those cases charged. Strength: Recent data, incl. info on DNA matching, multivariable model
Convictions 26%: (professional judges 13%; popular jury 13%; juvenile court, 1%); insufficient evidence 60%; order of non-suit[47] 12%; still before the courts 3%	Presence of extragenital injury (OR 1.1, 95% CI 0.6 – 2.0) and anogenital injury (OR 0.8, 95% CI 0.5 – 1.4) not associated with conviction	Limitations: Retrospective, single jurisdiction, small sample size for those ≥ 15 years of age. Mixture of analyses for association with legal outcome of both those less than and those older than 15 years of age. Do not report actual numbers (frequencies) in the analyses, bivariable statistics. Strengths: Detailed, descriptive information. Data from children < 15 years of age and for those ≥ 15 years of age mostly presented separately

in Canada and Scandinavia (143, 146, 148), and to up to 95% of the cases in two older studies (81, 138); spermatozoa were detected in 7 – 59% of the cases (19, 81, 89, 137-143, 145, 146); and finally, a DNA match with a suspect was achieved in less than one per cent in the South African cases (136) versus in 15 – 18 % of cases in Scandinavia (146, 148).

2.3.3.3 Associations between medico-legal findings and legal outcome

Some of these studies have found a significant association between any documented extragenital injuries and charge filing (143) or conviction (81, 142); in other studies, only moderate to severe injuries (including injuries to the head, neck, or face region) were associated with charge filing (139, 140) or conviction (138, 143). However, many of the studies disclosed no association at all between the documented injuries and charge filing (89, 137, 141, 144) or conviction (19, 99, 146). The South African study found an impact of medical information at different levels in the legal process: no association was found between the documentation of injuries and arrest of assailant or charge filing, however, a conviction was more likely if somatic injuries were documented (136).

Two older studies have found an association between the presence of anogenital injuries and more than one site of anogenital injury, respectively, and charge filing (139, 144), while in a more recent study, anogenital injury was associated with conviction (136). However, genital injury alone was not associated with charge filing (140, 143, 145) or conviction (19, 99, 143, 146) in most other studies.

Regarding the biological samples, the collection of sperm or semen was not associated with arrest of a suspect or charges filed in a Canadian study (141). However, documentation in police files of receiving forensic samples collected by medical staff was significantly associated with charge filing in another Canadian study (143). In general, the detection of sperm/semen was not associated with charge filing (89, 138, 140) or conviction (19, 81, 142, 143, 146). None of the 12 studies in the review explored the relationship between the DNA findings and legal outcomes (52). However, a DNA match was not associated with a conviction in two of the recent

studies (136, 146).

By going through the existing international literature on the field of medical findings and sexual assault, some important aspects need to be explored in a Nordic context. Until now, the degree to which STIs are a concern in health care after assault and the use of drugs in cases of DFSA has not been explored among Norwegian adult and adolescent sexual assault victims. In addition, prior studies of police-reported rapes have been performed in Norway, but there is limited knowledge of the police's use of medical information and of the impact that medical information has on legal outcome. As a health care worker dealing with victims of sexual assault, being aware of steps important for rape investigation is crucial. The intersection of these two fundamentally different services could benefit from each other, in order to better understand how to provide optimal care to, and respect the rights of, victims of sexual assault. This thesis contributes to such transfer of evidence and to filling knowledge gaps in a Norwegian context.

3 Aims of the study

3.1 Purpose

The overall purpose of the study is to increase knowledge about both the health care and the forensic services in sexual assault cases, in order to improve the quality of health care and attract attention to the legal use and benefit of medical information.

3.2 Objectives

Sexually transmitted infections (Paper I)

- What is the prevalence of STIs and BBVs among female adult and adolescent patients who visited the SAC?
- Could any of the STIs diagnosed at the initial visit have been assault-transmitted?
- Are there any associations between hospital data (background/assault characteristics, clinical findings) and the detection of STIs and BBVs?

Toxicological findings (Paper II)

- Which drugs are found in urine and/or blood among female adult and adolescent patients who visited the SAC?
- Are the test results consistent with self-reported voluntary intake or with proactive DFSA?
- Are there any associations between hospital data (background/assault characteristics, clinical findings) and the results of drug analyses?

Medico-legal findings and legal outcome (Paper III and the EA)

- What is the legal outcome among cases of rape and attempted rape?
- Are there any associations between medical findings (extragenital/anogenital injuries, and biological trace evidence) and charge filing?

4 Material and methods

4.1 Study design

This thesis is based on studies from two different samples of women reporting sexual assault to police and/or to a hospital SAC. All of the studies are retrospective and descriptive, but comparisons have been done for different outcome variables. The information derives from records from the regional police district as well as from the hospital (Figure 1). Both serve the county of Sør-Trøndelag, situated in central Norway with 295,000 inhabitants, including more than 170,000 living in the major city, Trondheim (149).

4.2 Setting: The Trondheim SAC

The SAC is situated at the Department of Obstetrics and Gynecology/Department of Pediatrics at St. Olavs Hospital, Trondheim University Hospital, Norway, and offers 24/7 low-threshold health care to those presenting after recent[48] sexual assault. The SAC provides acute psychosocial and medical care by trained nurses and resident/specialist physicians in gynecology or pediatrics. All patients are offered follow- up psychosocial support.

Furthermore, all patients are offered a forensic examination by the same team in conjunction with the medical assessment. If they consent, injuries are documented and biological trace evidence is collected from women's anogenital area and from other relevant areas of the body. The SAC stores the trace evidence for up to three months, after which it is discarded if not requested by the police. The police decide whether to request an analysis by the National Institute of Public Health[49] in Oslo.

Before 2003, the toxicological service was only offered on police request for those suspecting proactive DFSA, and most of the police-ordered analyses at that time were performed at the National Institute of Forensic Toxicology.[50] Between 2003 and

[48] If > 72 hours since assault, a consultation could be offered during office hours
[49] Institute of Forensic Medicine (FMI) existed until 2011, thenceforth organized under National Institute of Public Health
[50] National Institute of Forensic Toxicology existed until 2003, thenceforth organized under National Institute of Public Health

2006, the Department of Clinical Pharmacology, St. Olavs Hospital, offered such testing for patients suspecting proactive DFSA, regardless of police-report. Since 2007, the laboratory has offered analyses of urine/blood samples from all victims attending the SAC within the first few days after an assault.

4.3 Study samples

4.3.1 SAC recruited (Papers I and II)

These study samples originate from the SAC records only. In Papers I and II, we included female patients ≥ 12 years of age who were examined at the SAC between July 1, 2003 and December 31, 2010. Figure 5 depicts the exclusion and inclusion of patients from the studies.

During the study period, we performed a total of 730 individual consultations on patients ≥ 12 years. Males (n=20), and those not medically examined (n=43) were first excluded from the studies. All patients eligible for inclusion (n = 623 patients, involved in a total of n = 667 visits) received a letter of information, with instructions on how to actively withdraw their records from the studies (see section 4.8.1). Those who did not want their medical records to be used were excluded (n=9).

Later, we discovered that some patients had not been sexually assaulted according to criteria stated in a Canadian study (98) (n = 21), and additionally that some had not undergone medical examination (n=25). These patients were also excluded. A total of 573 patients involved in 612 individual consultations were therefore finally eligible for the studies. Further exclusion criteria are described in the Methods section of Papers I and II.

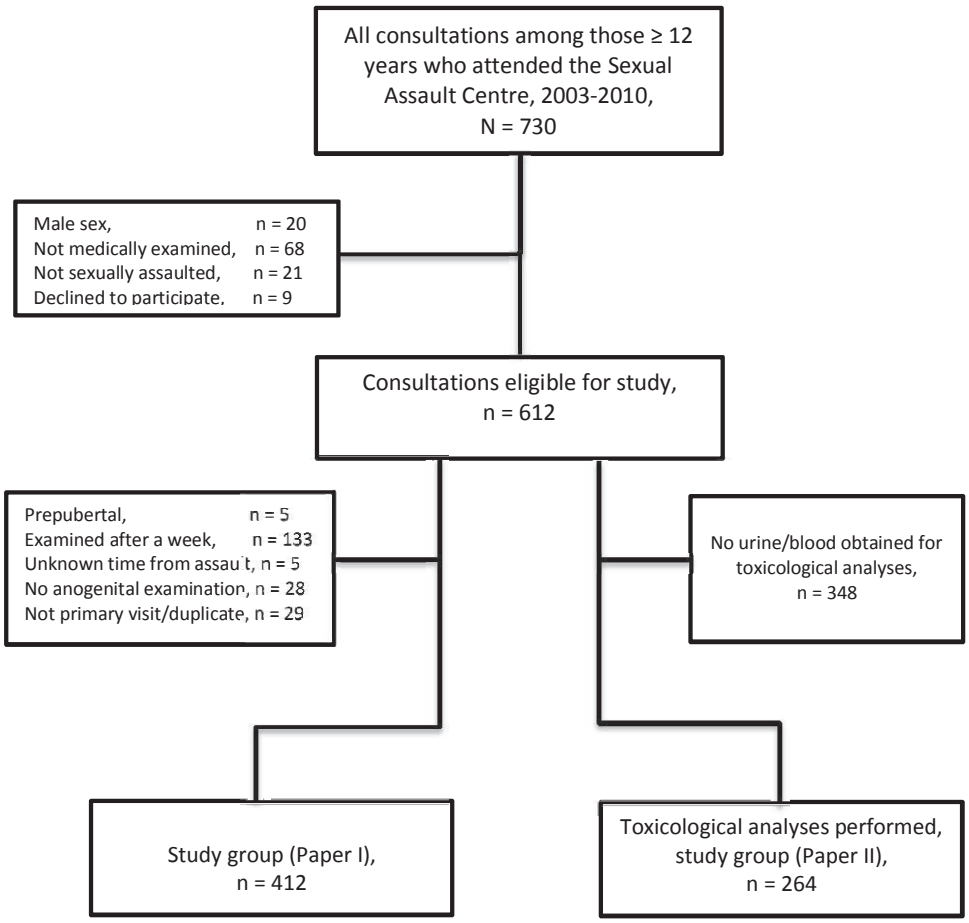

Figure 5 Flow chart for Paper I and II, cases based on patients attending the Trondheim Sexual Assault Centre during the period July 2003 through 2010

4.3.2 Police recruited (Paper III and expanded analyses (EA))

These samples consist of police-reported sexual assault cases. We identified all police-reported cases of rape and attempted rape of women ≥16 years of age, in Sør-Trøndelag, Norway.

For Paper III, cases reported between January 1, 1997 and June 20, 2003 were included. Cases were selected according to specific codes in the current Norwegian

Penal Code (4). In addition to rape (section 192) and attempted rape (section 192, cf. section 49), the codes "indecent assault on an unconscious subject," "indecent assault by means of threats/devious behavior," and "indecent conduct/exploitation facilitated by superior position" were included (27). For Paper III, a total of 222 cases were identified. Exclusion criteria were victim being < 16 years of age (age of sexual consent), male and unidentified victims (Figure 6). For the remaining 185 women, medical information from the SAC was available in 101 cases (55%).

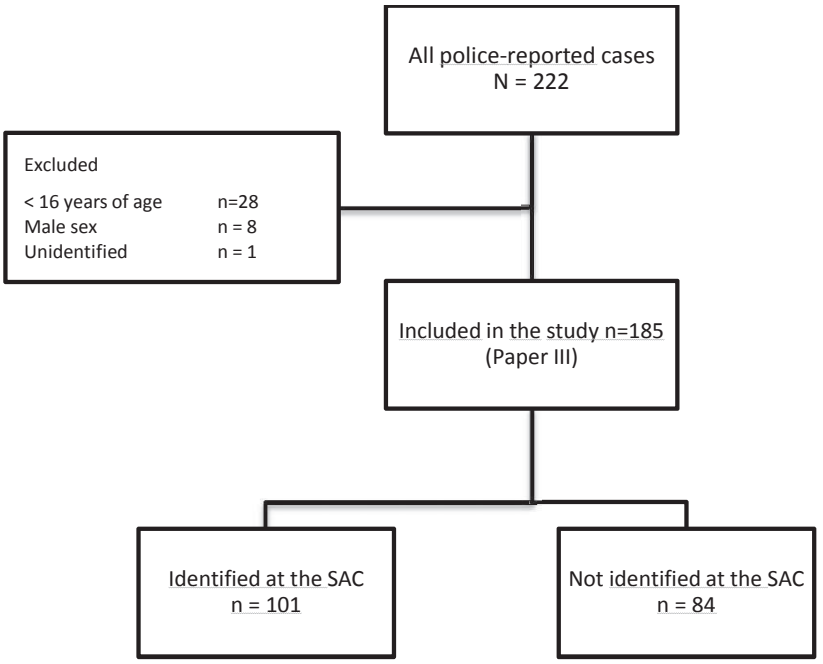

Figure 6 Flow chart for Paper III, cases based on police-reported rapes and attempted rape between 1997 and June 2003, in Sør-Trøndelag police district

Since the sample size for Paper III was small, additional data were collected from the period July 2003 through 2010. The Norwegian Penal Code has been revised after the data was collected for Paper III. For the analyses for the expanded period, in addition to rape (section 192, 1st – 3rd paragraph) and attempted rape, we therefore

included the so-called negligent[51] rape (section 192, 4th paragraph). However, the code "indecent assault by means of threats/devious behavior" had almost disappeared, and "indecent assault on an unconscious subject" had been included in the category of rape (into section 192, 1. paragraph, letter b) after the year 2000.

For the period July 2003 through 2010, altogether 475 cases of rape and attempted rape were identified. Hence, a total of 697 cases of rape and attempted rape were included in the expanded data set (Figure 7). Again we excluded victims being < 16 years of age, male and unidentified victims, as well as duplicate cases. Those not medically examined (n=6), those refused having their data used in the

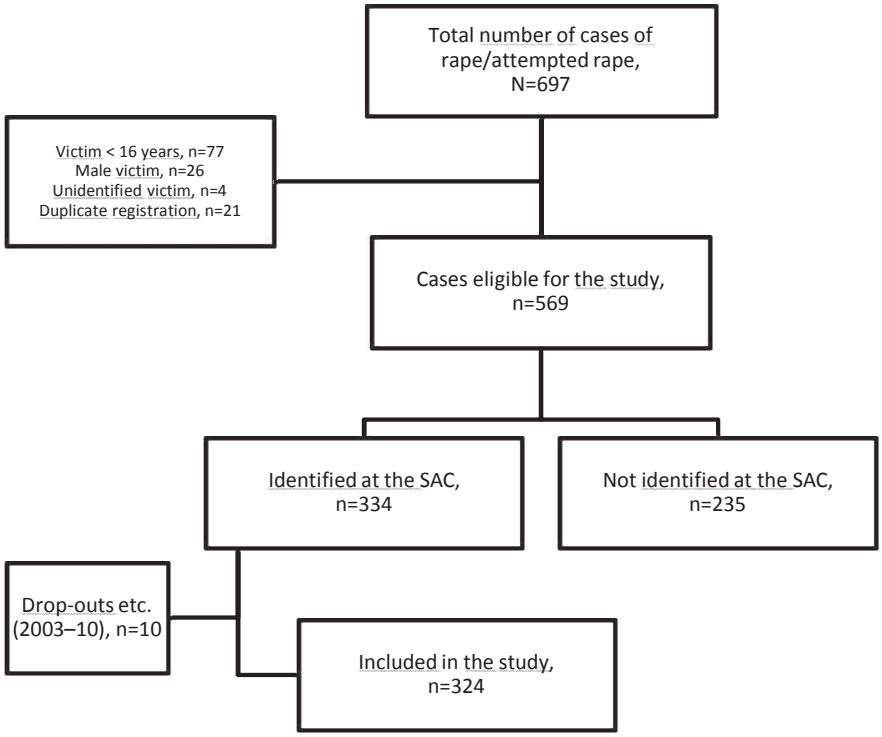

Figure 7 Flow chart of included and excluded cases of rape and attempted rape for the period 1997 – 2010, Sør-Trøndelag Police District. Regarding "drop-outs" etc. see text for details

[51] Norwegian: "Uaktsom voldtekt"

study (n=3), and those not sexually assaulted (n=1) were also excluded (see section 4.3.1). In the remaining 569 cases, medical information from the SAC was available in 324 cases.

4.4 Data collection and storage

4.4.1 From medical records (all studies)

Clinical, forensic, and laboratory information was extracted from the patients' records. For the period 1997 – 2003, the data was fed manually into a paper-based registration form (see Appendix 1). The registration scheme was then revised before the collection of new data from 2003 – 2010. For the second period, medical record information was registered through a web-based data collection system (case report form, CRF) developed and administered by the Unit of Applied Clinical Research at the Norwegian University of Science and Technology (see Appendix 2). Through this system, all information was encrypted and de-identified.

4.4.2 From police files (Paper III and EA)

For Paper III, information was manually collected from the police files, by a paper-based registration form (see Appendix 1). However, for the EA, we used a similar web-based data collection system (web-CRF, police, see Appendix 3) as for the hospital data (see section 4.4.1).

4.5 Definition of variables

4.5.1 Medical record variables (all studies)

Variables used in the different studies are shown in Table 7. The variables are grouped into the following categories: Patients' (victims') characteristics, assault and assailant characteristics, variables describing the clinical documentation, the laboratory findings, and finally, the police/legal variables (Paper III and the EA only). Some of the variables were differently defined in the first (Paper III) and the second (Paper I and II and EA) data collection periods (see section 6.1.1). Definitions of some of the variables follow below.

Table 7. Variables used in the different studies

Variables	Paper I	Paper II	Paper III	EA
Patients' (victims') characteristics				
Age	x	x	x	x
Country of origin	x	x		
Living situation		x		
Residency		x		
Education		x		
Occupation	x	x		
Vulnerability factors	x	x	x	x
Sexual/gynecological/hormonal history	x			
Assault and assailant characteristics				
Intake of alcohol	x	x	x	x
Intake of medicinal/recreational drugs		x		
Patients suspecting proactive DFSA	x	x		
Verified proactive DFSA findings		x		
Victim – assailant relationship	x	x	x	x
Venue	x	x	x	x
Time of day of assault		x		
Physical violence	x	x	x	x
Type of sexual assault	x	x	x	x
Police-reporting	x	x		
Assault-transmitted STI	x			
Mental state of the assailant			x	
Clinical documentation				
Interval from assault to examination	x	x	x	x
General status at SAC presentation	x	x	x	x
Extragenital Injuries		x	x	x
Anogenital injuries	x	x	x	x
Treatment	x			
Laboratory findings				
Detection of spermatozoa	x		x	x
Microbiology	x			
Toxicology		x		
Police variables				
Reported incident			x	x
Legal outcome			x	x
Information about police investigation			x	

EA: Expanded analyses; DFSA: DFSA: Drug-facilitated sexual assault; STI: Sexually transmitted infection; SAC: Sexual Assault Center

4.5.1.1 Patients' (victims') characteristics

Vulnerability factors

In Paper I, we defined the concept of vulnerability factors to include three features: mental health problems[52]; drug abuse[52]; and/or prior history of sexual assault. The definition of "mental health problems" included a diagnosis of affective/psychotic illness, use of antidepressant/antipsychotic medication, and a history of use of mental health services, deliberate self-harm/attempted suicide and eating disorder as defined in a previous study (150).

For Paper II, mental or physical disability was added to the "vulnerability factor" definition. For Paper III, the definition of vulnerability factors included the same four features as in Paper II, but "mental health problems" was restricted to psychiatric in-patient hospital admission or other psychiatric treatment (27).

Sexual, gynecological and hormonal history

Use of contraceptives was grouped into combined hormonal contraceptives, progestagen injections/implants, intrauterine device, and tubal ligation. In addition, a history of hysterectomy and menopausal status was recorded.

4.5.1.2 Assault and assailant characteristics

Intake of alcohol

Self-reported alcohol intake in relation to the assault was classified as no intake, < 5 units of alcohol, and ≥ 5 units of alcohol. We used a definition of one alcohol unit corresponding to 12 g ethanol, which equals approximately a 33 cl can of beer, a 12 cl glass of table wine, or a 4 cl drink of spirits (151).

Intake of medicinal/recreational drugs

Self-reported voluntary intake of medicinal or recreational (non-prescribed) drugs was recorded from the initial SAC visit, the follow-up visits, or from recent relevant hospital records.

[52] Prior or current

Patients suspecting proactive DFSA

A patient was classified as suspecting proactive DFSA when she herself raised a suspicion of being involuntarily drugged and assaulted, in combination with at least one of 16 associated symptoms, e.g. total or partial amnesia, "blackout," hangover, or symptoms inconsistent with the amount of alcohol or drugs voluntarily ingested (98).

Verified proactive DFSA

Among those suspecting proactive DFSA, those with a discrepancy between positive test for a sedative drug and self-reported intake were as a rule regarded as victims of proactive DFSA. However, in patients with a history of drug abuse and/or anxiety disorder, recent voluntary intake of such drugs could not be excluded and the case could not be defined as verified proactive DFSA.

Relationship between victim and assailant

The relationship between victim and assailant was defined as known, including previous or current partner/husband/boyfriend, family member, acquaintance (assailant known > 24 h), casual acquaintance (assailant known < 24 h), or stranger.

Venue

The location of the assault was defined as private (the victim's, the assailant's, or other person's residence) or public (any public indoor or outdoor location or a vehicle).

Physical violence

In Paper I and III, violence were graded as none/verbal threats, light/moderate, or severe. Severe physical violence was defined as presence of weapon and/or attempted strangulation. In addition, for Paper I, gagging, or punching/kicking towards head and for Paper III, fracture or internal injuries were included in this category.

Light/moderate violence was in Paper I defined as holding, tearing off of clothes, slapping, kicking, tying up, biting, sucking, stinging with needle, while for Paper III, only holding, punching, or kicking was included in this category. The use of physical violence was only dichotomized (yes/no) in Paper II.

Type of sexual assault

For Paper I, regarding STIs, penetration (whether vaginal, anal, oral) was defined as penile only. For Paper II, penetration included both by foreign object (vaginal, anal) and penis (vaginal, anal, oral). For Paper III, penetration of the different orifices was recorded separately. If more than one orifice was penetrated, this was ranked -- anal, vaginal, oral.

For all papers, when a finger was used to penetrate, as well as when other sexual acts like forced masturbation, attempted penetration, or touching up/fondling were reported, the assault was recorded as non-penetrative.

Reporting to the police

In Paper I and II, the event was recorded as police-reported if the patient said so or if the police requested a medico-legal report for investigational use.

Assault-transmitted STI

The STI was considered assault-transmitted when the patient testing positive had no prior coital experience, and, for herpes simplex virus (HSV), a positive swab NAAT was followed by HSV seroconversion in the follow-up period.

4.5.1.3 Clinical documentation

Extragenital Injuries

For Paper II, extragenital injuries were only dichotomized (yes/no). For Paper III, details of the observed extragenital injuries such as location, type, and number of injuries were described. For Paper III and the EA, extragenital injuries were categorized into minor (erythema, swelling, bruises, abrasions, lacerations, suction marks), moderate (bruising of head/neck expected to result in significant headache, lacerations requiring suture/dressing (143), bite/injection marks), and serious (evidence of attempted strangulation, head injury with concussion, and stab/incision wounds).

Anogenital injuries

For all papers and the EA, observed anogenital injuries included tears, abrasions,

and bruises (ecchymoses/petechiae). Redness and/or swelling were not regarded as injury (152-154). Anogenital injuries were initially diagnosed by gross visualization, but from 2008, photocolposcopy was mostly used. For Paper I, we recorded whether a full speculum examination or only inspection of the anogenital area was performed.

For Paper I and II, anogenital injuries were only dichotomized (yes/no). For Paper III and the EA, location, type and number were recorded.

Treatment

We recorded whether any prophylactic treatment was given at the initial visit according to Norwegian guidelines: e.g., a one-dose regimen of oral azithromycin, hepatitis B vaccination, and/or HIV PEP.

4.5.1.4 Laboratory findings

Detection of spermatozoa

For Paper I and the EA, the presence of spermatozoa at hospital microscopy[53] was given. For Paper III, the presence of spermatozoa found at the FMI (Institute of Forensic medicine, Oslo, Norway) was used.

Microbiology

Several different sample materials were submitted. Swabs taken from the urogenital (urethra, vagina, cervix and those labelled "urogenital secretion"), anorectal, and/or pharyngeal area were used for microbiological examination for NG, CT, and MG.[54] From 2005, a first void urine (FVU) sample was alternatively offered for examination for CT and MG.[54] If clinically indicated, specimens for additional microbiological agents, e.g. TV or HSV, were collected. Anogenital warts were clinically diagnosed.

The Department of Medical Microbiology, St. Olavs Hospital examined all swabs and urine samples. CT, MG, and HSV were diagnosed by NAAT. All positive tests were reproducible by re-testing. Standard culture techniques were used for the detection of

[53] Before 2007, performed at the Fertility Clinic, Department of Obstetrics and Gynecology. Later the Department of Cytology, St. Olavs Hospital took over this service
[54] From 2008

NG and TV.

A blood sample from all consenting patients was screened for serological markers of BBVs: HIV (HIVAg/Ab Combo test), hepatitis B (HBsAg, hepatitis B core antibody (HBcAb), and occasionally hepatitis B surface antibody (HBsAb)), hepatitis C (hepatitis C antibody (HCVAb)), syphilis (*Treponema pallidum* antibody), and occasionally HSV antibody. If not previously verified, positive screening tests were confirmed by alternative tests. For details of analytical methods for the detection of the different microbiological agents, see description in Paper I's Method section.

Toxicology

Patients were offered a toxicological screening according to the existing guidelines at that time, see section 4.2. The date and hour for toxicological sampling was recorded; if not specifically stated, the sampling was assumed to have taken place one hour after the arrival at the SAC. To estimate the time interval between the assault and the toxicological sampling, we used the mid-point of the time period for the assault (135).

Urine and/or blood samples were analyzed at the Department of Clinical Pharmacology, St. Olavs Hospital. If available, urine samples were screened for a predefined selection of substances likely to be used in DFSAs (155), and included ethanol and the drug classes benzodiazepines/benzodiazepine-like drugs, cannabinoids, opioids, central stimulants and some others, such as GHB and ketamine (see Supplementary Table 1, Paper II, for details). If the urinary screening test was positive, the corresponding substances were also quantified in serum. In cases with only serum available, specific analyses were prioritized according to the clinical characteristics. For details, see description in Paper II's Methods section 2.4.

Among those tested within 12 hours of the assault, the BAC was estimated from the measured serum ethanol concentration using a serum-to-blood ratio of 1.14. If a serum sample was missing, but the ethanol concentration in urine was known, a mean elimination phase urine-to-blood ratio of 1.345 was used to estimate the BAC (156). To estimate the BAC at the time of assault, concentrations were back-calculated assuming

no ethanol intake after the assault and a metabolic rate of 0.15 g/L ethanol per hour (124).

4.5.2 Police variables

In case of discrepancy between police and medical record information (e.g., regarding number of assailants), since Paper III and the EA were studies of police-reported assaults, information retrieved from the police files was chosen.

Reported incident

The reported incident was dichotomized into attempted rape versus rape. The latter category comprised the following crime denominations: "indecent assault on an unconscious subject," "indecent assault by means of threats/devious behavior," and "indecent conduct/exploitation facilitated by superior position." For the EA only, negligent[55] rape was also included in the rape category, see section 4.3.2.

Legal outcome

Legal outcome was classified according to the Norwegian Administration of Justice Act and regrouped into four categories: charges filed (prosecution of the case into a court of law); no suspect identified; charges not filed (dismissal); and "other reason." The latter category comprised cases in which the police concluded that no crime had been committed (unfounded); cases dropped because of withdrawal; cases treated without criminal proceedings; cases dropped because the suspect was deceased; cases let at rest (according to section 250); cases sent for investigation abroad; and those with missing legal outcome (see Figure 10 and 12, section 5.3). The category "charges not filed" comprised three categories: time-barred (too long an interval from incident to formal report), insufficient evidence, or suspect not legally responsible.

Information about police investigation

Investigational issues were classified according to whether forensic medical examination had been carried out (including whether trace evidence had been

[55] Norwegian: "Uaktsom voldtekt"

collected from the victim), whether analysis of the trace evidence had been conducted and if so, the results of the trace evidence analysis, the results of toxicological analyses, whether a medical forensic report had been requested by the police, and finally whether a physician from the SAC had been summoned as an expert witness in court.

Mental state of the assailant

The assailant was classified as "mentally disordered or impaired" if he was psychotic during the event, mentally retarded, or considered at risk of repeating the offense.

4.5.3 Quality control of the variables

For the purposes of Paper I and II, three students and I reviewed all patient records from this time period. To ensure accuracy, one of the students and I cross-checked with the records. Any discrepancies were addressed and consensus was reached in collaboration with the supervisors.

For Paper II, for correct classification of the variable "suspecting proactive DFSA," one of the co-authoring pharmacologists and I reviewed all assault descriptions case-by-case. If necessary, the case was discussed with all authors gathered. Still, a few cases qualified for the "uncertain" category.

For Paper III, all the collected medical information, including injury descriptions and sketches, and laboratory reports from the FMI, were reviewed and re-coded.

The final control of the data from the EA has not yet been completed, and the laboratory findings (trace evidence and DNA) were unfortunately not ready at the time of the analyses for this thesis. We therefore present those results as preliminary. However, medical record data used for the EA are the same as for Paper I and II.

4.5.4 The merging of the data (Paper III and the EA)

The data were merged by the following procedure. The collected police data were merged with the collected medical record data based on a key code (the personal identification code). Victims reporting more than one incident of rape were specifically

explored to avoid duplication of the cases, and the merged dataset was checked for mismatching date of assault in the police-file as compared to the SAC-file. The merged file was then de-identified. This procedure was conducted first for the 1997 – 2003 dataset (for Paper III), and later, for the 2003 – 2010 dataset. Finally, to achieve the dataset suitable for the EA, we merged the oldest (1997 – 2003) data file with the newest (2003 – 2010).

4.6 Data storage

The identifiable list (including the key identifier) of patients receiving the letter of information about the study (for Paper I and II) is stored in a separate research file area provided from the Data Protection Official[56] at the St. Olavs Hospital.

The first paper-based registration forms were fed manually into an SPSS[57] data file. After completing the collection of the newer data, the Unit of Applied Clinical Research at the Norwegian University of Science and Technology converted the web-based data into SPSS[57] files. The original files are stored in the same research file area as mentioned above.

4.7 Calculations and statistical analyses

For all analyses, descriptive characteristics were reported as frequencies and proportions for the categorical variables, and as mean, median, and ranges for the continuous variables.

For the comparisons, Pearson's $\chi 2$ test, Exact Unconditional test (or Fisher's Exact test), Pearson's $\chi 2$ test of heterogeneity, or Kruskal-Wallis test were used as appropriate. In addition, associations between the independent categorical variables and the outcome variables were explored by binary logistic regression analysis, calculating crude odds ratios (ORs) with corresponding 95% confidence intervals (CIs). We used multivariable logistic regression analysis without stepwise selection (157, 158). We entered patient's age (all papers), substance abuse (Paper I), interval from

[56] Personvernombud
[57] IBM Statistical Package for the Social Sciences (SPSS Inc. Chicago, IL, U.S.)

assault to sampling for toxicological test (Paper II), and interval from assault to clinical examination (Paper III and the EA) into the different models, as indicated below.

Missing data were calculated, but mostly excluded when statistical tests were performed. Statistical significance was assumed when $p < 0.05$. Data analysis was performed with SPSS[57] for Windows, version 16.0 (Paper III), and version 19.0 (Paper I, II and the EA).

4.7.1 Analyses for Paper I

We analyzed whether the independent variables were associated with a diagnosed STI/BBV. Patients testing negative for several microbes or serologic markers, but one test with uncertain/missing test result, were regarded as negative for the group outcome variable.

Associations between independent categorical variables and diagnosed STI/BBV were explored by logistic regression analysis. To adjust for patient age, we used age as a 5-categorical variable for the STI comparisons due to the skewed distribution of STI by age, and as a 2-categorical variable for the BBV comparisons. For the latter, we also adjusted for substance abuse.

4.7.2 Analyses for Paper II

We explored in detail those patients suspecting proactive DFSA, i.e., information on self-reported intake of alcohol/drugs was compared to the toxicological findings.

Among those tested for ethanol within 12 hours of the assault, we compared cases with a positive test for ethanol with cases with negative test (Table 4, Paper II). Multivariable logistic regression was applied to adjust for patients' age (3-categorical) and interval from assault to toxicological sampling (2-categorical). After estimating the BAC at the time of assault, we categorized the patients into tertiles according to BAC levels, and comparisons between the different "tertile-groups" were done for several of the independent variables. In addition, we compared those with a positive test for at least one drug other than ethanol with those with negative drug test (see section 5.2.1).

4.7.3 Analyses for Paper III and the EA

For Paper III, we compared cases charged in a court of law with the cases not charged, mainly because of insufficient evidence. For the statistical comparisons, those cases with no potential for a charge were therefore excluded, i.e., those cases with no suspect identified and those classified as "other reason" (see section 4.5.2 and Figure 10 and 12, section 5.3).

For Paper III, comparisons were done both for the total group of police-reported cases (Table 1, Paper III) and among those with SAC medical record information only (Table 2, Paper III). For the EA, only the corresponding latter sample was analyzed. We used multivariable logistic regression to adjust for age (3-categorical) and interval from assault to medical examination (as 2-categorical); see Table 13 and 16 in section 5.3.

In addition, for Paper III, to rule out whether some of the assault characteristics could have influenced the physical findings, we restricted the analysis of body injuries to only those patients subjected to physical violence (n=65), and the analysis of anogenital injury to only those patients subjected to anal and/or vaginal penetrative assault (n=71) (stratified analyses) (Table 14 in section 5.3.1).

Finally, for Paper III, we explored whether trace evidence analysis was associated with some characteristics (e.g., victim's age, the relationship to the assailant, self-reported penetration, and time interval from assault to collection).

4.8 Study approval

All studies were approved by the Regional Committee for Medical and Health Research Ethics (REK-Midt).

4.8.1 Study approval Paper I and II

All eligible patients (n=623) received a letter with general information (see Appendix 4 for the information letter in Norwegian), thereby giving the individual patients an opportunity to withdraw their records from the study. After receiving this letter, a total of 15 patients contacted the researchers. Nine patients withdrew their record information, two wanted only the main researcher (and not medical students)

to collect their record data, and four patients called to get more information about the study, but did not withdraw.

4.8.2 Study approval Paper III and EA

For Paper III and the EA, as the selection of cases was based on police-reported rapes, additional permission was obtained from the Norwegian Director General of Public Prosecutions[58] (through the Advisory Board on Secrecy and Research[59]).

The Norwegian Directorate of Health[60] was informed about the study, and the Norwegian Data Protection Authority[61] provided a license so that the study could be performed with an exception from the principle of informed consent. In addition, the study was approved by the Data Protection Officer[62] at the Norwegian Social Science Data Services.[63]

Because of the small sample size in Paper III, we wanted to expand the study. Permission to collect additional data was again approved by the REK-Midt, and in addition, by the Norwegian Director General of Public Prosecutions.[58] According to the Data Protection Officer,[62] these permissions were sufficient.

4.9 Ethical considerations

Information about sexual assaults and rapes reported to health care and/or police in Norway fills important gaps of knowledge in this field. This field is subjected to disproportionately large media attention, and many people express strong emotionally-laden opinions in newspapers and on the web. However, expert statements have often been difficult to communicate because of the lack of evidence-based medicine regarding sexual assaults. Knowledge has been difficult to achieve because of the sensitive nature of this kind of research.

Using already collected information from the clinical and police settings reduces the psychological strain for the patients. However, in future studies, one might

[58] Riksadvokaten
[59] Rådet for taushetsplikt og forskning
[60] Helsedirektoratet
[61] Datatilsynet
[62] Personvernombudet for forskning
[63] Norsk samfunnsvitenskapelig datatjeneste AS, NSD

consider asking for patients' consent to participate in research, preferably in the follow-up phase after the sexual assault rather than during the period of acute crisis, see section 6.4.

The negative ethical issues in the project are mainly related to handling and storing sensitive data about the patients/victims, and in the case of police-data, of a third party (that is, the suspects). In addition, some of the results in the study could eventually be experienced as offensive, or at least not positive, for the group of women who have experienced sexual assaults.

In retrospect, we contacted the identified patients by mail to inform about the study. This could be experienced as a painful and humiliating reminder of an assault which might have happened many years ago. Whatsoever, the study participants' safety is a primary concern in any research. Since the letter of information was constructed in a very general way, a reprisal for reporting a sexual assault (e.g., by a violent partner) should be reduced to a minimum.

It may be perceived as unethical to investigate only female patients subjected to sexual assault, but too few men have contacted the SAC or reported rape to the police, resulting in an insufficient sample size for any of the statistical analyses for male patients. However, for gaining gender equality in research, future studies of sexual assaults should include male patients as well.

5 Results/Overview of papers

5.1 Sexually transmitted infections (Paper I)

5.1.1 Results according to aims (Paper I)

What is the prevalence of STIs and BBVs among the SAC patients[64]?

The prevalence of STIs was twice that of BBV-markers. CT was detected in a total of 25 patients (6.4%), while two tested positive for MG (1.9%).[65] At the examination of swabs collected from two patients with clinically suspicious HSV genital lesions, one tested positive for HSV. Additionally, eight patients (1.9%) had visible anogenital warts. Altogether, at least one STI was diagnosed in 35 patients (8.5%). Only one patient was diagnosed with more than one STI, who tested positive for CT and demonstrated genital warts.

Seven patients had serological markers compatible with prior HBV infection, while nine were HCVAb positive. A total of 14 patients (3.7%) tested positive for at least one BBV-marker.[66] Two patients tested positive for both HBcAb and HCVAb, and one for both HCVAb and MG.

Could any of the STIs diagnosed at the initial visit have been assault-transmitted?

One patient tested positive for CT and claimed to have no previous coital experience; we therefore concluded that she probably had acquired an assault-transmitted infection. The patient with HSV infection demonstrated a suspected HSV primary-like ulcer around 53 hours after the assault. In this case, at initial visit, genital swabs were HSV NAAT positive. The patient had an HSV serology test collected at the initial visit, which was negative, and by follow-up after around six weeks, both HSV IgM and IgG were positive. We therefore concluded that this infection most probably was assault-transmitted.

Are there any associations between relevant hospital data and the STI findings?

Comparisons between those with and without an STI are shown in Table 2 and in

[64] All test results are from the initial visit
[65] n=393 tested for CT and n=106 tested for MG
[66] Additionally, 20 patients tested positive for HBsAb at the initial visit

the E-table, Paper I. Substance abuse and stating a non-Western assailant was associated with STI, after adjustment for patient age.

Patients' age was significantly associated with both STIs and BBVs. Patients aged 16 – 19 years had significantly higher STI prevalence than any other age group. Stratifying patients by age groups in accordance with the CDC (159), we found a CT prevalence as shown in the Table 8. For BBV markers, those ≥ 25 years of age had significantly more positive tests than younger patients. After adjustment,[67] substance abuse and being unemployed was associated with BBV positive findings at the initial SAC visit (Table 3, Paper I).

Table 8. Chlamydia trachomatis: Positive test at the initial SAC visit by age groups

Patient age, years	Positive/tested (%)
< 15	1/20 (5)
15 - 19	15/139 (11)
20-24	6/129 (5)
25-29	2/36 (6)
30-39	1/37 (3)
> 40	0/30 (0)
Total	**25/391 (6)**

5.1.2 Results from follow-up visits

After the initial visit, 195 patients (47%) attended at least one follow-up consultation and 81 patients underwent a second clinical examination by a physician at the SAC. Thirty-three patients were re-tested for an STI within 6 weeks of the initial visit. All tests were negative, except one CT test "converted" from a negative at initial visit.

After at least 3 months, re-screening for serologic markers of HIV/syphilis was conducted in 114 patients, while 57 had a re-screening for hepatitis B/C markers after at least 6 months. No new cases were positive for HIV or HBcAb during follow-up, while one turned out positive for syphilis (not tested at the initial visit) and three for HCVAb (one seroconverted, while two were not tested at the initial visit). Each of these

[67] Substance abuse adjusted for age, and being unemployed adjusted for age and substance abuse

three had additional risk factors for HCV infection. In addition, 19 patients were only tested for HBsAb on follow-up: 26 were positive, 22 of whom after recent vaccination.

5.1.3 Assault-transmitted STI and legal outcome

Neither of the two women who probably had acquired an assault-transmitted infection reported their assaults to the police. Hence, no legal consequences ensued for the assailants in these cases.

5.2 Toxicological findings (Paper II)

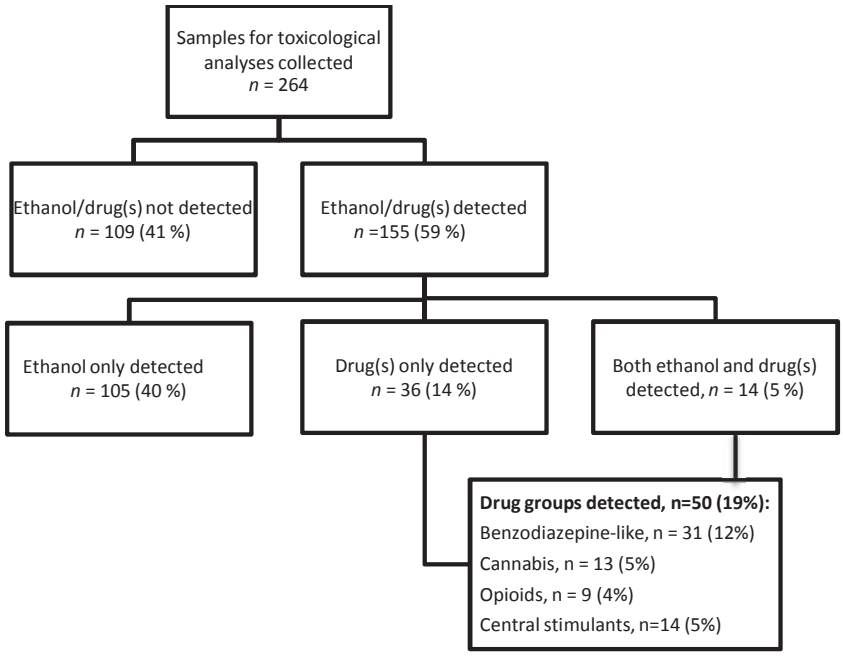

Figure 8 Drug and ethanol findings (Paper II)

5.2.1 Results according to aims (Paper II)

Which drugs are found in urine/blood among the patients who visited the SAC?

Among the 264 patients included, ethanol and/or drugs were detected in 155 (59%). The different drug groups detected are shown in Figure 8. None of the patients

tested positive for GHB or ketamine. Overview of the drug combinations and detailed information of drugs other than ethanol (including concentrations in serum) are shown in Table 2 and 3, Paper II.

Among 120 patients tested for ethanol within 12 hours of the assault, 85% tested positive. The median estimated BAC at the time of the examination was 1.20 g/L.

Could the findings be consistent with voluntary intake or with proactive DFSA?

Among those 57 patients who suspected proactive DFSA, 13 tested positive for at least one drug other than ethanol. The number of positive cases for each drug among the patients suspecting proactive DFSA is shown in Table 3, Paper II, right column. Details of each case are given in Table 9 above, modified according to Birkler *et al* (106). Some of the benzodiazepines detected have long half-lives (clonazepam, diazepam). It is therefore difficult to interpret these findings when the interval from assault to test is long. High concentrations might be caused by recent intake, and not from the period before the assault. Some cases require further comments:

Case # 1: The patient was intoxicated (high levels of ethanol) upon arrival at the hospital. She reported taking some pills which she believed were analgesics, but might instead have been drugged with clonazepam?

Case # 2: We found very high serum levels of benzodiazepines (clonazepam, diazepam) only four hours after the assault, and even though stating voluntary intake, someone may have surreptitiously drugged her or made her take more than the usual dosage.

Case # 8: Although no unexpected findings, there was a high level of zopiclone, which might be caused by intake of the drug after the assault or by surreptitious drugging with her regular hypnotic?

However, in summary, only in five patients a positive test for sedative drugs (clonazepam (n=1) and diazepam/oxazepam (n=4)) was not accounted for by self-reported voluntary intake. All these patients reported a history of either drug abuse or anxiety. Thus, no cases could be unequivocally attributed to proactive DFSA.

Table 9. Drug findings among the 13 cases suspecting surreptitious drugging who had positive toxicological findings (of drugs

Case #	Time from assault to sampling	Blood alcohol concentration, g/L	Self-reported alcohol intake (units)	Drugs detected, serum concentration ng/ml (nmol/l)[68]
1	12	1.8	> 5	Clonazepam 25 (79)→
2	5	0	< 5	Clonazepam 152 (481)↑↑; diazepam 1650 (5890)↑↑; (oxazepam 70 ↓); methamphetamine 270 (1809)↑; (amphetamine 42 (311) →)
3	81	0	< 5	Diazepam 40 ↓; (oxazepam 6↓↓); nitrazepam 60 ↓; Morphine 50 (175) →; oxycodone (positive in urine only)↓; cannabis 0.8 ↓; amphetamine/ methamphetamine (urine only tested)
4	76	0	< 5	Diazepam 2300 (8078)↑↑; (oxazepam 41↓↓); amphetamine (40 (300)/methamphetamine 242 (1622)↑
5	10	0.3 (estimated from urine)	> 5	Flunitrazepam 6 (20)→
6	54	0	> 5	Oxazepam 11 (38)↓↓
7	3 (urine)	1.5 (estimated from urine)	< 5	Oxazepam 117 ↓
8	13	0.6 (estimated from urine)	> 5	Zopiclone 100 (257)↑
9	13	0	< 5 (one beer, then black-out)	Cannabis 0.5 ↓; amphetamine 287 (2123)↑
10	37	2.3 (estimated from urine)	> 5 (been drinking for many days)	Amphetamine (urine only tested)
11	20	0	> 5	Amphetamine and methamphetamine (urine only tested)
12	165	0	0	Methamphetamine (urine only positive)
13	39	0	> 5 (claimed to have been forced to drink)	Methylphenidate (urine only tested)

[68] Arrows indicate whether the measured serum concentration is within the therapeutic range (→), or higher (↑) or lower (↓) than the therape

other than alcohol), modified according to Birkler et al (106)

Self-reported intake of drugs	Unexpected findings (no self-reported intake)	Comments
Was given some unknown white pills (thought it was an analgesic)	Yes, clonazepam	Surreptitious drugging with clonazepam?
Clonazepam; fluoxetine	Yes, diazepam (and amphetamines)	Surreptitious drugging with clonazepam/diazepam? (Suspected being drugged with morphine sulphate)
Oxazepam; nitrazepam; amphetamine and ecstasy	Yes, diazepam (cannabis and analgesics)	Presented late. Most likely intake after the assault (esp. analgesics)
No information on intake, but reported anxiety/depression	Yes, diazepam/oxazepam (amphetamines)	Most likely intake after the assault
Flunitrazepam, i.e. several h before arrival	No	Surreptitious drugging with flunitrazepam? But s-concentration no higher than expected for regular use over time?)
No information on intake, except for venlafaxine, but reported anxiety/depression	Yes, oxazepam	Presented late. Concentration may have been considerably higher at the time of assault, provided no intake after the assault.
Oxazepam	No	Drug positive as expected, she was found outdoors perished and "under the influence of alcohol/drugs"
Zopiclone	No	Higher concentration than expected from therapeutic use. Intake after assault or surreptitious drugging?
No information on intake. Plastic bag with white powder collected from her vagina at pelvic examination	(Cannabis/amphetamine only)	Presented too late for detection?
Reported alcohol/drug abuse, but no exact information on intake, except alcohol	(Amphetamine only)	
Prior record of amphetamine intake	No	
Voluntarily injected amphetamine, but higher dose than intended?	No	Claimed to have become "paralyzed" after the drug was injected
Methylphenidate	No	Arrived too late for detection of alcohol

ɔeutic range

Is there any association between relevant hospital data and the drug findings?

Alcohol positive vs. negative

We compared patients testing positive for ethanol with those testing negative (among those tested within 12 hours of the assault), see Table 4, Paper II. Those testing positive for ethanol more often reported a high intake of alcohol (≥ 5 units), reported a public place of assault, stranger assailant, more than one assailant, and assault occurring between midnight and 7 a.m. However, those testing negative for ethanol more often had at least one vulnerability factor. Adjusting for patients' age and interval from assault to toxicological sampling did not alter any of the relations.

Lower vs. higher estimated BAC at time of assault

Median BAC at time of the assault was 1.87 g/L, and the distribution of the BAC is shown in Figure 9. When separating the cases into tertiles according to estimated BAC at time of assault (Table 11), there was a significant association between high estimated BAC at the time of assault and high self-reported intake of alcohol, suspicion of proactive DFSA, the assailant being a stranger, and a clinical impression of inebriation on examination.

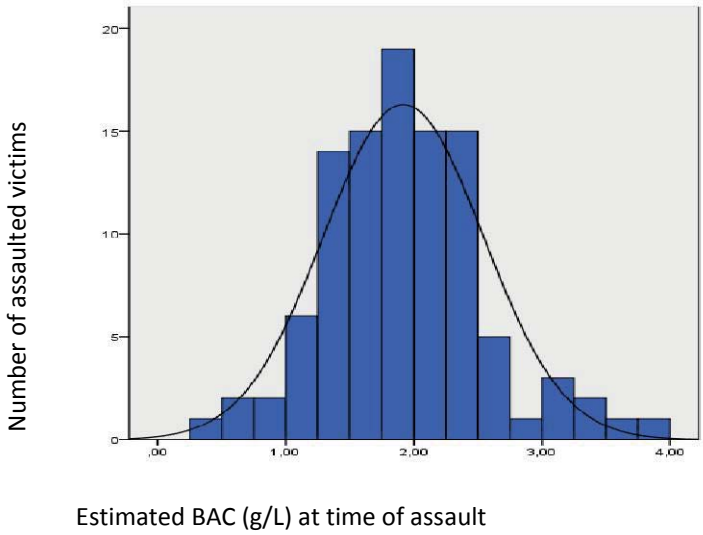

Figure 9 Distribution of estimated blood alcohol concentration (BAC) at the time of the assault among 102 ethanol positive patients tested within 12 hours of the assault

Drug positive vs. negative

For this thesis, I explored some of the associations between case characteristics and drug findings (Table 12 below). Patients' background characteristics like older age, mental health problems/drug abuse, no intake of alcohol, and unemployment were significantly associated with a positive test for at least one drug other than ethanol. The assault occurring being between 7 a.m. and midnight and serious extragenital injuries were also associated with a positive drug test.

5.2.2 Toxicological findings and legal outcome

For the expanded analyses (1997 – 2010) described in section 5.3.4, we explored whether sampling for a toxicological test was performed, and if so, whether a positive toxicological finding was associated with charge filing. No association with legal outcome was found for either of these two variables (see Table 10 below, which is an extract of Table 16).

Among those 13 cases suspecting surreptitious drugging and who had positive toxicological findings referred in Table 9, only five were identified in the police files as reported rapes. None of these five cases ended in court: three were not charged because of insufficient evidence, while no suspect was identified in the other two cases.

Table 10. Toxicological tests among 324 women who reported rape to the police by charge filing[69], in Sør-Trøndelag, Norway, 1997 through 2010

		Charges filed, N=213		
Variable	**Total, N=324 n (%)**	**Yes, n=38 n (%)**	**No, n=175 n (%)**	***p*-value**
Toxicological test collected, n=324				
No	198 (61)	24 (63)	103 (59)	
Yes	126 (39)	14 (37)	72 (41)	0.62[70]
Toxicological test result, n=126				
Negative	37 (29)	3 (21)	25 (35)	
Positive	89 (71)	11 (79)	47 (65)	0.38[71]

[69] Missing excluded from the analyses
[70] Chi-square, *df*=1
[71] Exact unconditional test

Table 11. Blood alcohol concentration (BAC) (estimated) at mean time of assault by background and assault characteristics and clinical findings among 120 female victims attending the Trondheim SAC 2003 – 2010 and tested for alcohol within 12 hours of the assault

Variable	Estimated BAC (g/L) at time of assault			*p* (test method[72]), degrees of freedom
	< 1.43, n=40, n (%)	1.43 - 2.014, n=40, n (%)	> 2.014, n=40, n (%)	
Age groups (n=120)				
12-17 years	9 (23)	5 (13)	5 (13)	
18-24 years	20 (50)	24 (60)	27 (68)	
≥ 25 years	11 (28)	11 (28)	8 (20)	0.51[73]
Vulnerability factors (n=120)				
Yes	9 (23)	13 (33)	15 (38)	
No	31 (78)	27 (68)	25 (63)	0.34
Alcohol consumption (n=118)				
Intake of < 5 units	20 (51)	6 (15)	9 (23)	
Intake of ≥ 5 units	19 (49)	34 (85)	30 (77)	0.001
Suspected being drugged (n=115)				
Yes	3 (8)	9 (24)	12 (32)	
No	37 (93)	28 (76)	26 (68)	0.027
Occupation (n=118)				
Employed/student	26 (67)	32 (80)	30 (77)	
Unemployed	13 (33)	8 (20)	9 (23)	0.36
Type of sexual assault (n=116)				
Penetration	28 (72)	20 (51)	21 (55)	
No penetration/other acts	4 (10)	3 (8)	2 (5)	
No recollection	7 (18)	16 (41)	15 (40)	0.12[74]

Physical violence (n=86)				
Light/moderate/severe	28 (80)	20 (74)	17 (71)	
None/verbal	7 (20)	7 (26)	7 (29)	0.71
Location of assault (n=110)				
Private	28 (72)	21 (57)	19 (56)	
Public	11 (28)	16 (43)	15 (44)	0.28
Victim/assailant relationship (n=106)				
Known	35 (95)	24 (67)	20 (61)	
Stranger	2 (5)	12 (33)	13 (39)	0.002
More than one assailant (n=109)				
Yes	3 (8)	8 (22)	8 (23)	
No	35 (92)	28 (78)	27 (77)	0.16
Assailant origin (n=91)				
Norwegian/western	26 (77)	24 (80)	18 (67)	
Non-western	8 (24)	6 (20)	9 (33)	0.49
Time of the day of assault (n=120)				
7 a.m. – midnight	14 (35)	9 (23)	9 (23)	
Midnight – 7 a.m.	26 (65)	31 (78)	31 (78)	0.35
Clinically intoxicated (n=116)				
Yes	12 (31)	28 (74)	30 (77)	
No	27 (69)	10 (26)	9 (23)	0.0001
Extragenital injury (n=114)				
Yes	22 (56)	26 (68)	23 (62)	
No	17 (44)	12 (32)	14 (38)	0.55
Anogenital injury (n=108)				
Yes	14 (38)	8 (22)	11 (32)	
No	23 (62)	29 (78)	23 (68)	0.31

[72] Chi-square, df=2 unless otherwise stated
[73] Chi- square, df=4
[74] Kruskall Wallis test for ordinal data, df=2

Table 12. Drug findings by background and assault characteristics and clinical findings among 264 female patients attending the Sexual Assault Center between July 1, 2003 and December 31, 2010

Variable	Drug[75] positive, *n* = 50, *n* (%)	Drug[Error! Bookmark not defined.] negative, *n* = 214, *n* (%)	*p*
Background characteristics			
Patient age, *n* = 264			
12 – 17 years	6 (12)	51 (24)	
18 – 24 years	19 (38)	118 (55)	
≥ 25 years	25 (50)	45 (21)	< 0.001[76]
Vulnerability factors, *n* = 264			
No vulnerability factor	6 (12)	89 (42)	
Physical or cognitive disability	8 (16)	17 (8)	
Mental health problems/substance abuse	35 (70)	73 (34)	
Previous sexual assault(s)	1 (2)	35 (16)	< 0.001[77]
Alcohol consumption, *n* = 257			
No intake	13 (28)	22 (11)	
Intake of < 5 units	10 (21)	40 (19)	
Intake of ≥ 5 units	24 (51)	148 (71)	0.005[76]
Suspected proactive drug-facilitated sexual assault, *n* = 252			
No	35 (73)	160 (78)	
Yes	13 (27)	44 (22)	0.41[78]
Occupation, *n* = 255			
Student	13 (28)	115 (55)	
Employed	10 (22)	55 (26)	
Unemployed	23 (50)	39 (19)	< 0.001[76]
Assault reported to the police, *n* = 241			
No	9 (21)	78 (39)	
Yes	33 (79)	121 (61)	0.029[78]
Assault characteristics			
Type of sexual assault, *n* = 259			
No penetration/other acts	6 (13)	14 (7)	
Penetration	27 (56)	115 (55)	
No recollection	15 (31)	82 (39)	0.31[76]

Physical violence, *n* = 174			
No/verbal	6 (19)	46 (32)	
Yes	26 (81)	96 (68)	0.13[78]
Location of assault, *n* = 243			
Private	32 (70)	128 (65)	
Public	14 (30)	69 (35)	0.55[78]
Victim/assailant relationship, *n* = 235			
Known	41 (89)	153 (81)	
Stranger	5 (11)	36 (19)	0.19[78]
More than one assailant, *n* = 239			
No	33 (75)	169 (87)	
Yes	11 (25)	26 (13)	0.053[78]
Assailant age group, n=192			
≤ 24 years	10 (29)	60 (38)	
25 – 34 years	11 (31)	64 (41)	
≥ 35 years	14 (40)	33 (21)	0.061[76]
Assailant origin, *n* = 207			
Western	25 (63)	124 (74)	
Non-western	15 (38)	43 (26)	0.14[78]
Time of day of assault, *n* = 256			
7 a.m. – midnight	20 (44)	49 (23)	
Midnight - 7 a.m.	26 (57)	161 (77)	0.005[78]
Clinical findings			
Clinically intoxicated, *n* = 256			
No	27 (55)	135 (65)	
Yes	22 (45)	72 (35)	0.19[78]
Extragenital injury, *n* = 255			
None	10 (21)	68 (33)	
Minor/moderate	34 (71)	135 (65)	
Serious	4 (8)	4 (2)	0.029[79]
Anogenital injury, *n* = 244			
No	31 (71)	149 (75)	
Yes	13 (30)	51 (26)	0.58[78]
Time from assault to sampling, *n* = 264			
< 12 h	20 (40)	108 (51)	
≥ 12 h	30 (60)	106 (50)	0.18[78]

[75] Drug(s) other than ethanol, but could in addition be positive for ethanol
[76] Chi-square test, *df* = 2
[77] Chi-square test, *df* = 3
[78] Chi-square test, *df* = 1

5.3 Medico-legal findings and legal outcome (Paper III and the EA)

5.3.1 Results according to aims (Paper III)

What is the legal outcome among cases of rape and attempted rape?

For the 185 cases included in Paper III, the reported assault was classified as attempted rape in 28 cases (15%), and the rest were rape notifications. Legally binding decisions had been reached in all but one of the 185 cases. The legal outcome is illustrated in Figure 10. A total of 30 cases were charged in a court of law. Of these,

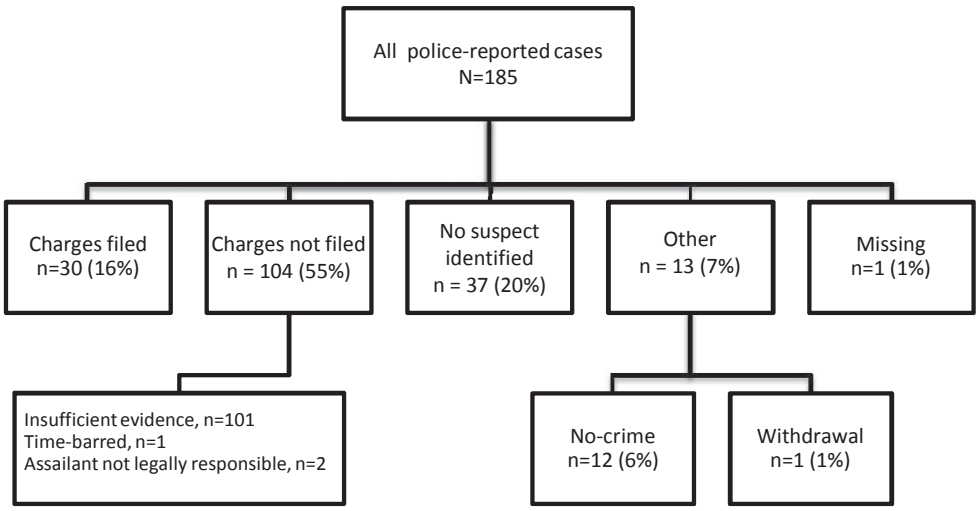

Figure 10 Legal outcome among all police-reported cases of rape and attempted rape, Sør-Trøndelag police district 1997 through June 2003 (Figure 1, Paper III)

22 convictions were reached,[79] while eight cases ended in an acquittal. In three of these cases, the suspects were initially convicted in the city/district court, but acquitted upon a second trial in the Court of Appeal.

Is there any association between medical findings and charge filing?

Only those who had been medically examined at the SAC were included in these analyses. Figure 11 shows the legal outcomes for the 101 cases medically examined.

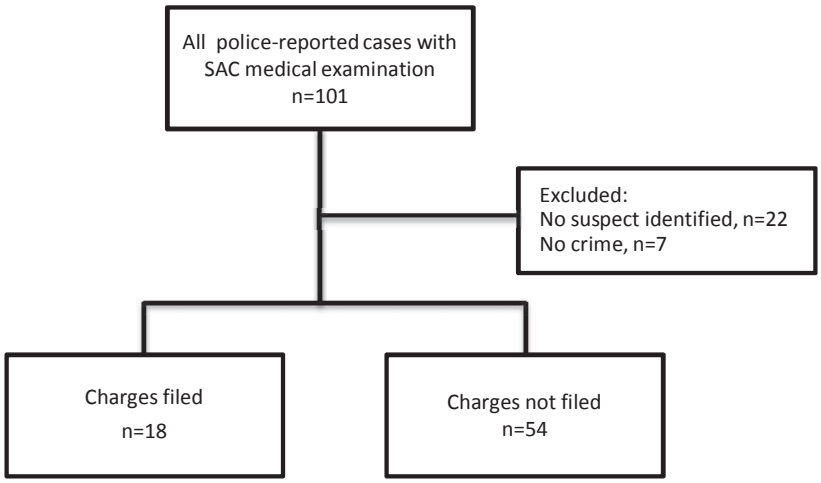

Figure 11 For those rape victims who had been medically examined at the SAC, comparisons were done between those cases with a potential for charge to be filed. Those 54 where a charge was not filed included 53 cases with insufficient evidence and one case were the assailant was not legally responsible

Table 13 below describes details of the medico-legal findings by legal outcome. Extragenital injuries were more often present when charges were filed vs. not filed, especially moderate/ serious injuries. However, this association fell below the level of

[79] Among the 22 cases ending with a convicting sentence, one assailant was convicted in each of 15 cases. As many as four assailants were convicted in one case. In contrast, one and the same assailant was convicted in four and two cases, respectively. All the 18 assailants went to prison for a period of 45 days to four years. In addition, assailants were convicted with up to 9 years of additional preventive supervision. Compensation for criminal injuries was granted to 24 victims

Table 13. Medico-legal findings among 101 women who reported rape and attempted rape to the police and had

Variable	Total N=101 n (%)	Charges filed, N=72 Yes, n=18 n (%)	No, n=54, n (%)	*p*-value
Victim's age, n=101				
16 - 17 years	23 (23)	5 (28)	13 (24)	
18 - 24 years	45 (45)	7 (39)	23 (43)	
≥ 25 years	33 (33)	6 (33)	18 (33)	0.94[83]
Interval assault to medical examination, n=99				
≤ 24 h	70 (71)	12 (71)	40 (76)	
> 24 h	29 (29)	5 (29)	13 (25)	0.72[84]
Emotional state at examination, n=79				
Calm, rational	16 (20)	4 (27)	9 (21)	
Distressed (e.g. crying, shaking)	63 (80)	11 (73)	33 (79)	0.71[84]
Extragenital injuries, n=90				
None	41 (46)	5 (29)	24 (51)	
Minor	39 (43)	8 (47)	18 (38)	
Moderate /serious	10 (11)	4 (24)	5 (11)	0.23[83]
≥ 4 extragenital injuries, n=90				
No	67 (82)	13 (81)	36 (84)	
Yes	15 (18)	3 (19)	7 (16)	0.84[84]
Anogenital injuries, n=92				
No	78 (85)	13 (87)	40 (82)	
Yes	14 (15)	2 (13)	9 (18)	0.71[84]
More than one anogenital injury, n=91				
No	83 (91)	13 (87)	43 (90)	
Yes	8 (9)	2 (13)	5 (10)	0.91[84]
Any injury, n=95				
No	41 (43)	6 (33)	23 (47)	
Yes	54 (57)	12 (67)	26 (53)	0.32[85]
Spermatozoa found at SAC, n=66				
No	50 (76)	7 (70)	28 (78)	
Yes	16 (24)	3 (30)	8 (22)	0.73[84]
Trace evidence sent for analysis FMI, n=89				
No	59 (66)	3 (20)	34 (71)	
Yes	30 (34)	12 (80)	14 (29)	< 0.001[85]
Spermatozoa detected at FMI, n=30				
No	13 (45)	5 (42)	6 (46)	
Yes	16 (55)	7 (58)	7 (54)	0.82[85]

[80] Those with missing information were excluded from the analyses
[81] Adjusted for age (3-categorical)
[82] Adjusted for time interval (2-categorical)
[83] Kruskal Wallis test, *df*=2
[84] Exact Unconditional test
[85] Chi-square, *df*=1

undergone medical examination, and by charge filing[80], in Sør-Trøndelag, Norway, 1997 through June 2003

	Crude OR	OR adjusted for age[81]	OR adjusted for interval assault to med. exam.[82]	OR adjusted for age and interval assault – exam.
	Reference		Reference	
	0.8 (0.2 – 3.0)		0.8 (0.2 – 3.2)	
	0.9 (0.2 – 3.5)		0.7 (0.2 – 3.0)	
	0.8 (0.2 – 2.6)	0.8 (0.2 – 2.6)		
	Reference	Reference		
	Reference	Reference	Reference	Reference
	0.8 (0.2 – 2.9)	0.6 (0.1 – 2.6)	1.1 (0.2 – 5.1)	0.9 (0.2 – 4.4)
	Reference	Reference	Reference	Reference
	2.1 (0.6 - 7.6)	2.3 (0.6 - 8.7)	2.2 (0.6 - 8.0)	2.4 (0.6 - 9.2)
	3.8 (0.8 - 20)	4.7 (0.9 - 26)	3.7 (0.7 - 19)	4.5 (0.8 -25)
	Reference	Reference	Reference	Reference
	1.2 (0.3 – 5.3)	1.4 (0.3 – 6.8)	1.0 (0.2 – 4.8)	1.2 (0.2 – 6.1)
	1.5 (0.3 – 7.7)	1.5 (0.3 – 8.4)	1.3 (0.2 – 7.0)	1.4 (0.2 – 7.6)
	Reference	Reference	Reference	Reference
	Reference	Reference	Reference	Reference
	1.3 (0.2 – 7.6)	1.3 (0.2 – 7.7)	1.8 (0.3 – 11)	1.7 (0.3 – 11)
	Reference	Reference	Reference	Reference
	1.8 (0.6 – 5.5)	2.0 (0.6 – 6.4)	2.1 (0.6 – 6.8)	2.4 (0.7 – 8.4)
	Reference	Reference	Reference	Reference
	1.5 (0.3 – 7.2)	1.9 (0.4 – 10)	1.6 (0.3 – 8.2)	2.0 (0.3 – 12)
	Reference	Reference	Reference	Reference
	9.7 (2.4 – 40)	11 (2.5 – 45)	13 (2.4 – 66)	14 (2.4 – 78)
	Reference	Reference	Reference	Reference
	1.2 (0.2 – 5.8)	1.6 (0.3 – 8.9)	1.7 (0.3 – 9.8)	4.2 (0.4 – 46)

significance, even after adjusting for victims' age and interval from assault to medical examination. There were no differences in charge filing when the victim had more than three extragenital injuries. Anogenital injuries were documented in 14 victims and ranged from none to ten (median two); five were single site, four victims had two or three injuries, while four had four or more injuries documented. There were no differences in the frequency of anogenital injuries among those cases where charges were filed vs. not filed, and no differences between those with more than one anogenital injury vs. fewer. Adjusting for age and time interval from assault to medical examination did not change this pattern. The documentation of any injury (extragenital and/or anogenital) or both extragenital and anogenital injury had no association to charges being filed.

In the result section of Paper III, we stated that we restricted the analysis of anogenital injuries vs. charges filed to only those (n=71) reporting anal/vaginal penetration. The numbers are given in Table 14, and show that there were still no association between anogenital injuries and charge filing (p=0.70[86]). When restricting the analyses of extragenital injuries vs. charges filed to only those reporting physical violence (n=65), a higher proportion of those with injuries was charged in court, however, not significantly higher (p=0.20[86]).

Table 14. Extragenital and anogenital injury according to history in police-reported rapes, and by charge filing[87], in Sør-Trøndelag, Norway, 1997 through June 2003

Characteristics/variable	Examined SAC N=101	Charges filed N=72	
		Yes, n=18	No, n=54
	n (%)	n (%)	n (%)
Extragenital injuries among women exposed to violence, n=65			
Yes	37 (57)	10/13 (77)	16/32 (50)
No	23 (35)	3/13 (23)	13/32 (41)
Missing	5 (8)	0	3/32 (9)
Anogenital injuries among women exposed to penetration, n=71			
Yes	10 (14)	1/10 (10)	7/44 (16)
No	58 (82)	9/10 (90)	34/44 (77)
Missing	3 (4)	0	3/44 (7)

[86] Exact unconditional test
[87] Excluded cases with unknown assailant, n=22 and unfounded cases, n=7

During examination at the SAC, swabs were collected from 90 victims. Only in 30 cases, the police submitted these swabs for analysis. Police decision to submit trace evidence for analysis was associated with charge filing. Adjusting for victim's age and interval from assault to examination even enhanced this association (Table 13). Spermatozoa were identified in a total of 16 swabs collected from the victims' anogenital and/or umbilical area. Spermatozoa were equally present among the charged and uncharged cases (Table 13). In the five cases showing a DNA-match between swabs collected from the victim and the suspect, a charge was filed in four cases, while in one case evidence was considered insufficient[88] (Table 2, Paper III).

5.3.2 Additional exploration of trace evidence analysis (Paper III)

We wanted to explore whether trace evidence analysis was associated with certain victim and assault characteristics. These analyses are illustrated in Table 15. There was no pattern towards more analyses being performed when the assailant had

Table 15. Trace evidence analysis by certain characteristics of 72 women police-reporting rapes with charge filing potential[89], Sør-Trøndelag, Norway, 1997 through June 2003

Variable	Charges filed, total, N=72	Trace evidence analyzed, n=63		
		Yes, n=26 n (%)	No, n=37 n (%)	*p*-value
Victim's age, n=101				
16 - 17 years	18 (25)	5 (19)	11 (30)	
18 - 24 years	30 (42)	14 (54)	14 (38)	
≥ 25 years	24 (33)	7 (27)	12 (32)	0.43[90]
Victim – assailant relationship, n=97				
Partner/acquaintance	48 (69)	18 (69)	21 (60)	
Casual acquaintance /stranger	22 (31)	8 (31)	14 (40)	0.46[91]
Self-reported penetration[92], n=82				
Yes	56 (95)	19 (86)	30 (100)	
No	3 (5)	3 (14)	0	0.07[93]
Interval assault to medical examination, n=99				
≤ 24 h	52 (74)	23 (92)	26 (72)	
> 24 h	18 (26)	2 (8)	10 (28)	0.10[93]

[88] Among the 4 cases where swabs from the victim showed unidentified male DNA, only one were not charged because of unidentified suspect, while in the 3 other cases evidence was considered insufficient
[89] Excluded cases with unknown assailant and unfounded cases
[90] Chi-square, *df*=2
[91] Chi-square, *df*=1
[92] Anal, vaginal or oral penetration
[93] Fisher's exact test

a more distant relationship to the victim. Similarly, we found no significant differences in women's age, in self-reported penetration, or in the interval from assault to medical examination vs. trace evidence analysis, although the latter two were borderline significant.

5.3.3 Police use of forensic report, expert witness and toxicology (Paper III)

In 84 of the cases in which SAC medical examination had been performed, the police requested a medical forensic report; in each of the 18 cases forwarded to court, such a report was included in the police files. On the other hand, a medical report from the SAC had also been sent to the police in 46 of the 54 cases where charges were not filed. An expert witness from SAC testified in court during the proceedings in only five cases.

In 11 cases, victims had urine and/or blood sampled for toxicological tests. Nine tests from the victims were positive: four tests were positive for ethanol and five tests were positive for other drugs like benzodiazepines, opioids, cannabis, and central stimulants. No association was found whether toxicological analysis was performed or not, or whether test results were positive or negative, and charge filing among those tested ($p=0.68$ and 0.50, respectively).

5.3.4 Results according to aims for the expanded period 1997 - 2010

What is the legal outcome among cases of rape and attempted rape?

The legal outcome of the cases for the total period of 1997 – 2010 is shown in Figure 12. The proportion of cases ending in court (charges filed) was halved: i.e., from 16% in the period 1997 – June 2003, to as low as 8% in the period July 2003 – 2010. Those cases classified as no crime was correspondingly doubled: i.e., from 6% in the first period to 12% in the second.

After the exclusion of cases with no potential for a charge to be filed, a total of 380 cases were left, of which 213 had medical information from the SAC (see Figure 13 below).

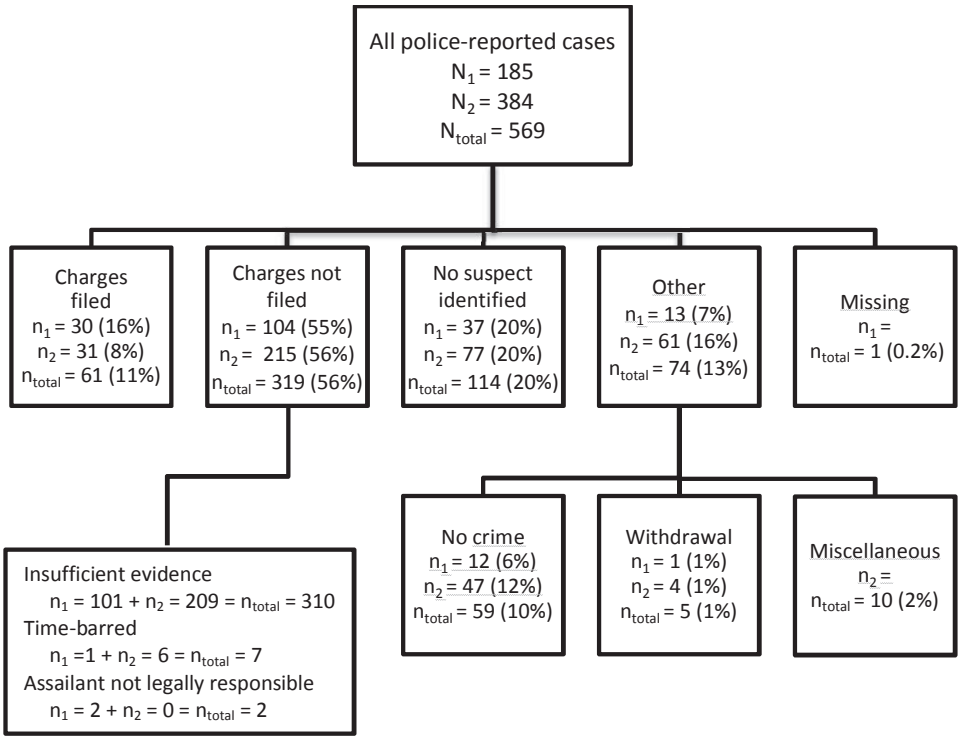

Figure 12 Legal outcome among all police-reported cases of rape and attempted rape, Sør-Trøndelag police district. The subscript 1 is for the period 1997 – 2003, subscript 2 from 2003 – 2010, while subscript named "total" is for 1997 – 2010. The group of legal outcomes named miscellaneous (only from period 2) included: those cases treated outside criminal proceedings (n=4), those cases dropped because the suspect was deceased (n=4), those cases let at rest (according to section 250) (n=1), and finally those cases sent for investigation abroad (n=1)

Table 16. Medico-legal findings among 324 women who reported rape and attempted rape to the police and had

Variable	Total N=324 n (%)	Charges filed, N=213 Yes, n=38 n (%)	No, n=175 n (%)	*p*-value
Victim's age				
16 - 17 years	71 (22)	7 (18)	45 (26)	
18 - 24 years	154 (48)	16 (42)	79 (45)	
≥ 25 years	99 (31)	15 (40)	51 (29)	0.40[97]
Interval assault to medical examination, n=321				
≤ 24 h	232 (72)	29 (78)	121 (70)	
> 24 h	89 (28)	8 (22)	53 (31)	0.28[98]
Emotional state at examination, n=297				
Calm, rational	61 (21)	6 (18)	38 (24)	
Distressed (e.g. crying, shaking)	236 (80)	28 (82)	123 (76)	0.45[98]
Extragenital injuries, n=298				
None	115 (39)	12 (32)	65 (41)	
Minor	156 (52)	18 (49)	81 (51)	
Moderate /serious	27 (9)	7 (19)	13 (8)	0.14[99]
≥ 4 extragenital injuries, n=289				
No	200 (69)	24 (67)	110 (71)	
Yes	89 (31)	12 (33)	45 (29)	0.61[98]
Anogenital injuries, n=296				
No	225 (76)	27 (82)	128 (77)	
Yes	71 (24)	6 (18)	38 (23)	0.55[98]
More than one anogenital injury, n=294				
No	251 (85)	28 (85)	140 (85)	
Yes	43 (15)	5 (15)	24 (15)	0.95[100]
Any injury, n=310				
No	107 (35)	12 (32)	63 (38)	
Yes	203 (66)	26 (68)	105 (63)	0.49[98]
Spermatozoa found at SAC, n=229				
No	165 (72)	16 (62)	92 (73)	
Yes	64 (28)	10 (39)	34 (27)	0.24[98]
Toxicological test collected, n=324				
No	198 (61)	24 (63)	103 (59)	
Yes	126 (39)	14 (37)	72 (41)	0.62[98]
Toxicological test result, n=126				
Negative	37 (29)	3 (21)	25 (35)	
Positive	89 (71)	11 (79)	47 (65)	0.38[100]

[94] Those with missing information were excluded from the analyses
[95] Adjusted for age (3-categorical)
[96] Adjusted for time interval (2-categorical)
[97] Chi-square, *df*=2
[98] Chi-square, *df*=1
[99] Kruskal Wallis test, *df*=2
[100] Exact unconditional test

undergone medical examination, and by charge filing[94], in Sør-Trøndelag, Norway, 1997 through 2010

	Crude OR	OR adjusted for age[95]	OR adjusted for interval assault to med. exam.[96]	OR adjusted for age and interval assault to med. exam.
	Reference		Reference	
	1.3 (0.5 – 3.4)		1.2 (0.4 – 3.2)	
	1.9 (0.7 – 5.1)		1.6 (0.6 – 4.5)	
	1.6 (0.7 – 3.7)	1.5 (0.6 – 3.6)		
	Reference	Reference		
	Reference	Reference	Reference	Reference
	1.4 (0.6 – 3.7)	1.4 (0.5 – 3.7)	1.6 (0.6 – 4.5)	1.6 (0.6 – 4.5)
	Reference	Reference	Reference	Reference
	1.2 (0.5 – 2.7)	1.2 (0.5 – 2.7)	1.2 (0.5 – 2.7)	1.2 (0.5 – 2.7)
	2.9 (1.0 – 8.8)	2.8 (0.9 – 8.5)	2.9 (1.0 – 8.9)	2.8 (0.9 – 8.6)
	Reference	Reference	Reference	Reference
	1.2 (0.6 – 2.7)	1.2 (0.6 – 2.7)	1.2 (0.6 – 2.7)	1.2 (0.6 – 2.7)
	1.3 (0.5 – 3.5)	1.4 (0.6 – 3.8)	1.3 (0.5 – 3.5)	1.4 (0.5 – 3.8)
	Reference	Reference	Reference	Reference
	Reference	Reference	Reference	Reference
	1.0 (0.4 – 3.0)	1.0 (0.3 – 2.8)	1.0 (0.3 – 2.9)	1.0 (0.3 – 2.8)
	Reference	Reference	Reference	Reference
	1.3 (0.6 – 2.8)	1.3 (0.6 – 2.7)	1.3 (0.6 – 2.9)	1.3 (0.6 – 2.9)
	Reference	Reference	Reference	Reference
	1.7 (0.7 – 4.1)	1.7 (0.7 – 4.1)	1.6 (0.7 – 4.0)	1.6 (0.7 – 3.9)
	1.2 (0.6 – 2.5)	1.2 (0.6 – 2.4)	1.3 (0.6 – 2.8)	1.3 (0.6 – 2.8)
	Reference	Reference	Reference	Reference
	Reference	Reference	Reference	Reference
	2.0 (0.5 – 7.6)	1.3 (0.3 – 5.6)	1.0 (0.2 – 4.1)	1.1 (0.2 – 4.8)

Is there any association between medical findings and charge filing?

Figure 13 shows the legal outcomes for the 324 cases medically examined.

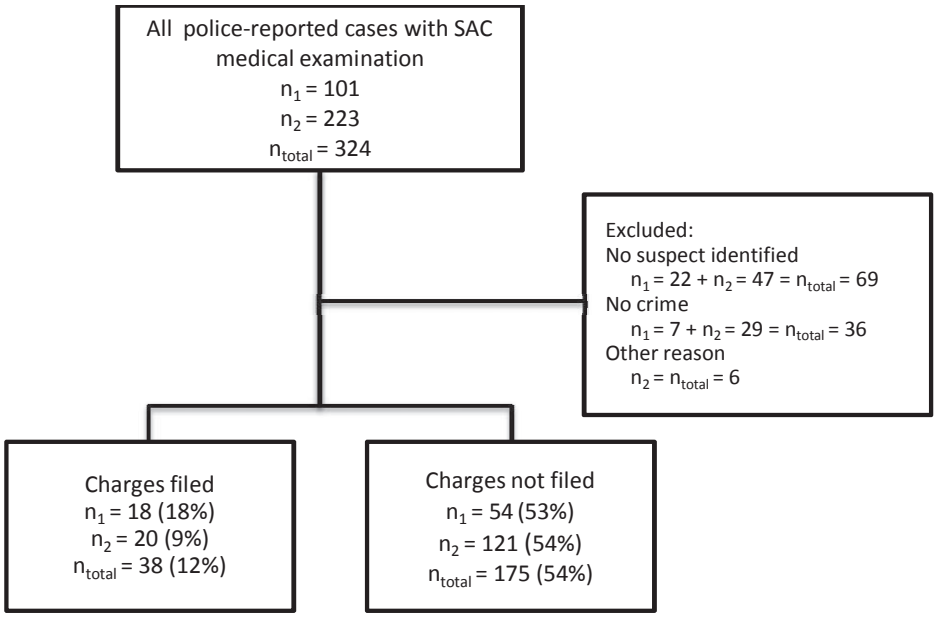

Figure 13 Legal outcome among the police-reported rape cases where medical examination at the SAC had been performed. Comparisons were done between those cases with a potential for charge to be filed. For explanation of the subscripts 1, 2 and total see Figure 12. Other reason included cases dropped because of withdrawal (n=1), cases treated outside criminal proceedings (n=2), cases dropped because the suspect was deceased (n=2), and cases let at rest (n=1)

The same variables presented in Table 13 were analyzed for the total period 1997 – 2010, and the results are presented below in Table 16. For this total period, there was no significant association with charge filing for any of the medico-legal variables analyzed. However, moderate/serious body injury was more often documented among the cases taken to court, although only borderline significant after adjustment.

Key findings

- Altogether, at least one sexually transmitted infection (STI) was diagnosed in 8.5% of the patients attending the Sexual Assault Center (SAC)
- The proportion of women diagnosed with genital chlamydial infection was notable (6.4%), but lower than in the comparable clinical population
- Differentiating STI transmitted during assault from pre-existing STI is difficult, and in only two cases the STI was suspected to be assault-transmitted
- STI prevalence was highest among 16 – 19 year-old patients, while those positive for blood-borne virus (BBV) were older; claiming a non-Western assailant was associated with STI; substance abuse was associated with both STI and BBV
- Ethanol and/or drugs were detected in 59% of the SAC patients tested: At least one drug other than ethanol was detected in 19%: Benzodiazepine-like substances in 12%; cannabis in 5%, opioids 4%; and central stimulants in 5%
- 22% of the patients suspected proactive drug-facilitated sexual assault: however, the detected sedative drugs were not accounted for by voluntary intake in only five patients. All five had a history of drug abuse/anxiety. Therefore, no cases could unequivocally be attributed to proactive DFSA
- Among those tested for ethanol within 12 hours of the assault, 85% tested positive. The median estimated blood alcohol concentration (BAC) at the time of the assault was 1.9 g/L
- Those testing positive for ethanol more often reported a public venue, stranger assailant, and more than one assailant. However, those testing negative for ethanol more often had another vulnerability factor
- There was a significant association between increasing estimated BAC at the time of assault and suspicion of proactive DFSA and stranger assailant
- The proportion of cases taken to court was 16% in 1997 – 2003, but reduced to 8% during 2003 – 2010. Cases were not filed in 55 – 56% because of insufficient evidence, in 20% no suspect was identified, while in 6 – 12% the case was classified as no crime
- The police's decision to submit trace evidence for analysis was associated with charge filing (1997 – 2003)
- Moderate/serious body injury was more often documented among the cases taken to court, though this was of only borderline significance after adjustment

6 Discussion

6.1 Methodological limitations and strengths

In addition to the limitations and strengths already discussed in the three papers, some more general methodological issues will be considered in the following section. The limitations and strengths of the study design will be explored, as well as the different types of research errors. These research errors are separated into random and systematic errors (or bias), the latter categorized into selection bias, information bias, and confounding (160). Some comments regarding missing information and considerations of the differences between clinical and statistical causal pathways will be addressed. Finally, the phenomenon of generalizability, reliability, and validity will be discussed.

6.1.1 Study design and data collection

Our studies are all retrospective (cross-sectional) and descriptive, thereby not allowing us to conclude on causal relationships. However, for Paper III and the EA, even if we retrospectively collected and then merged information from medical and police records, this study could be regarded as having some qualities otherwise belonging to a prospective cohort design. The medical findings were mostly documented shortly after the sexual assault. On the other hand, the legal decisions were often set up many months ahead. We collected the information about legal outcome almost two years after the assault was first reported to the police, thereby optimizing information on final legal outcomes.

The retrospective design did not allow us to collect more information than already present in the records. Information was gathered in a clinical setting, not in a research-designed context using standardized CRFs. Due to haste or to other urgent on call-duties, some questions might not have been asked, e.g. whether attempted strangulation was reported, resulting in the underreporting of such assault details. In addition, there is a possibility that SAC staff or police officers may not always exactly copy into the records the information as it was given, but rather may have recorded an abbreviated or “edited” version. Finally, information could be erroneously collected

into the database by the researchers (see section 4.5.3). Information collected from different sources, i.e., both from nurses' and physician's records, might have increased the possibility of complete collection of variables such as voluntary intake of medicinal drugs, although this could result in some differential misclassification (see 6.1.3.2). Furthermore, the close access to medical records allowed us to study relations and details not always accessible for research.

The definition of the variables shifted throughout the data collection period, thereby making comparisons between the older and the newer data challenging. We did this because updated standards for classification was recommended by others, for example, for injuries and mental health problems (143, 150, 161). As a result, more detailed information was collected in the second data collection period.

6.1.2 Random error

Random error describes the variability in the data that we cannot readily explain (160). The larger the study, the more this kind of error is reduced. It affects the precision of the point estimate (in this thesis OR) represented by the width of the CI: wide CIs represent less precision. In our studies, many of the outcome groups were small, resulting in wide CIs and imprecise effect estimates. However, since police and medical record data altogether has been collected from a total of 14 years, the relatively large sample size increases our studies' credibility.

To evaluate to what degree our results were influenced by type II statistical error, an example could be drawn from Paper III. We increased the sample size by two thirds in the EA. Through this, we wanted to evaluate whether such enlargement could result in the association between, for example, body injury and charge filing becoming significant. In Paper III, the unadjusted p-value was 0.23 when comparing extragenital injuries by charge filing (Table 13 in section 5.3). For the total period, the same comparison resulted in a lower unadjusted p-value of 0.14 (Table 16 in section 5.3), hence, only a minor degree of type II statistical error was illustrated.

6.1.3 Systematic error (bias)

6.1.3.1 Selection bias

This bias is introduced to a study by erroneous selection of participants. Several levels of selection bias exist in the studies presented in this thesis. For all papers, we assume a skewed selection of study participants, since those attending SACs or those filing a police report are not representative of all raped women. As stated in section 2.2.1, probably only a proportion of victims contact SACs and/or police after a sexual assault (6, 14, 17-23). Those women experiencing a fear of injury or death, assaulted by a stranger, and concerned about contracting STIs might be over-represented in the present studies (22, 162, 163). In addition, those attending SACs more often than the general population could be familiar to seeking health care for other reasons (164). Similarly, those attending the police after rape are more often registered in the criminal records (26). In contrast to those contacting centers for battered women, non-Western subjects seem to be underrepresented among Norwegian SAC patients (165, 166).

It is reasonable to believe that most of the female patients brought to our hospital after sexual assault are identified. Even if the patients are admitted to other hospital departments due to diagnoses other than sexual assault (e.g. serious intoxication, head injury, or attempted suicide), our SAC will be contacted for forensic examination and follow-up. However, not all patients disclose information of recent sexual assault when contacting health care. In addition, reported incidents of sexual assault not classified by the police as rape codes (described in section 4.3.2) would not be included in our studies.

Since the papers in this thesis aimed to study medical findings, those not subjected to medical examination were excluded. For Papers I and II, those not medically examined (n=68, 10%) are assumed to have longer interval from assault, be less injured, and only claiming psychosocial support. This will limit our possibility to study, for example, differences in assault and assailant characteristics regarding these patients. In addition, those not wanting their records used in the study were excluded

from Papers I and II. However, this fraction was rather small (n=9, 1%) and probably had no noteworthy impact on our results.

Among those 612 eligible consultations (depicted in Figure 5, section 4.3.1), we compared those included vs. those not included in the papers regarding certain characteristics (Table 17 below). Those who attended the SAC more than one or two weeks after the assault were excluded from Paper I and II, respectively.

For both papers the individuals excluded were younger, and more often were students, thus an obvious selection of cases. This could have misled us to underestimate STI prevalence among the SAC patients because younger age is associated with STI (159, 167). There also seemed to be a selection of coitally experienced women included, which could have increased the prevalence of STI found in Paper I.

Those described in Paper II more often suspected proactive DFSA, more often had been drinking alcohol, and more often had no recollection of the assault compared to those patients excluded (Table 17). Hence, there is a possibility of us overestimating the occurrence of these phenomena among the sexually assaulted women attending the SAC. However, the proportion of women with a history of drug abuse, which could influence both STI and suspicion of proactive DFSA prevalence, were only borderline significantly more often included in the papers. Furthermore, those with no anogenital examination were not included in the study for Paper I (n=28, 5%). Those refusing such inspection could represent those less injured, as described above, indicating a falsely high prevalence of anogenital injury among those included in the study. However, the prevalence of anogenital injury in Paper I was lower than that found by others.

For Paper II, only those tested for alcohol/drugs participated. In 2008, we changed the guidelines for collection of toxicological tests, lowering the threshold for testing and offering tests to far more patients. Because of this change, only 30% of those attending the SAC during 2003 – 2007 were included, in contrast to as many as 70% of those attending during the 2008 – 2010 time period ($p < 0.001$, chi-square, df=1). Accordingly, twice as many of the participants in Paper II suspected proactive

Table 17. Certain characteristics of those cases included in Paper I and II vs. those not included, among 612[101] eligible Sexual Assault Center

	Paper I		
Variable	**Included in Paper I, n = 412, n (%)**	**Excluded from Paper I, n = 161, n (%)**	***p*[102]**
Background characteristics			
Patient age, n = 573			
12 – 17 years	114 (28)	83 (52)	
18 – 24 years	188 (46)	41 (26)	
≥ 25 years	110 (27)	37 (23)	< 0.001
Occupation, n = 552			
Student	217 (55)	113 (73)	
Employed	99 (25)	22 (14)	
Unemployed	81 (20)	20 (13)	< 0.001
Country of origin, n = 568			
Norwegian/Western	389 (95)	140 (88)	
Non-Western	20 (5)	19 (12)	0.003
Substance abuse, n = 569			
No	366 (90)	152 (94)	
Yes	42 (10)	9 (6)	0.077
Prior coital experience, n = 525			
No	31 (8)	55 (40)	
Yes	357 (92)	82 (60)	< 0.001
Assault characteristics			
Alcohol consumption, n = 524			
No intake	75 (19)	67 (54)	
Intake of < 5 units	86 (22)	19 (15)	
Intake of ≥ 5 units	239 (60)	38 (31)	< 0.001
Suspected proactive drug-facilitated sexual assault, n = 549			
No	340 (85)	131 (87)	
Yes	58 (15)	20 (13)	0.69
Type of sexual assault, n = 554			
No penetration/other acts	38 (9)	27 (18)	
Penetration	244 (61)	98 (65)	
No recollection	121 (30)	26 (17)	0.001
Assault reported to the police, n = 530			
No	121 (32)	67 (44)	
Yes	258 (68)	84 (56)	0.007
Clinical findings			
Extragenital injury, n = 516			
None	143 (35)	83 (74)	
Minor/moderate	251 (62)	28 (25)	
Serious	10 (3)	1 (1)	< 0.001
Anogenital injury, n = 522			
No	303 (76)	112 (91)	
Yes	96 (24)	11 (9)	< 0.001
Interval from assault to medical examination, n = 568			
< 72 h	381 (93)	19 (12)	
72 h – 1 week	31 (8)	4 (3)	
> 1 week	0	133 (85)	< 0.001

[101] For Paper I, cases which were not primary visit (n=39) were excluded from the comparisons
[102] Chi-square test, *df* = 1 or *df* = 2

· consultations from July, 2003 through 2010

	Paper II		
	Included in Paper II, n = 264, n (%)	Excluded from Paper I, n = 348, n (%)	p[102]
	n = 612		
	57 (22)	145 (42)	
	137 (52)	106 (31)	
	70 (27)	97 (28)	< 0.001
	n = 588		
	128 (50)	210 (63)	
	65 (26)	62 (19)	
	62 (24)	61 (18)	0.007
	n = 607		
	252 (96)	315 (91)	
	10 (4)	30 (9)	0.016
	n = 608		
	226 (87)	317 (91)	
	35 (13)	30 (9)	0.060
	n = 564		
	14 (5)	75 (24)	
	243 (95)	232 (76)	< 0.001
	n = 559		
	35 (14)	119 (39)	
	50 (20)	61 (20)	
	172 (67)	122 (40)	< 0.001
	n = 588		
	195 (77)	311 (93)	
	57 (23)	25 (7)	< 0.001
	n = 591		
	20 (8)	48 (15)	
	142 (55)	231 (70)	
	97 (38)	53 (16)	< 0.001
	n = 566		
	87 (36)	111 (34)	
	154 (64)	214 (66)	0.63
	n = 552		
	78 (31)	157 (53)	
	169 (66)	130 (44)	
	8 (3)	10 (3)	< 0.001
	n = 555		
	180 (74)	261 (84)	
	64 (26)	50 (16)	0.003
	n = 607		
	238 (90)	196 (57)	
	20 (8)	16 (5)	
	6 (2)	131 (38)	< 0.001

DFSA in the first time period vs. the latter (34% vs. 16%, p=0.007, df=2, KW-test[103]). This heterogeneity of the study participants included in Paper II makes our results more difficult to interpret.

For Paper III, for the purpose of studying the impact of medical findings on legal outcome, only those having undergone examination at the SAC were included. A prior study drawn from the same study sample has addressed characteristics of those medically examined as compared to those not, among the police-reported cases of rape and attempted rape (27). Victims not examined at the SAC more often had more than one week delay from assault to police-report and more often reported the assault to a rural police office. Only very few victims of attempted rape had a medical examination, and parallel to this, more often reported vaginal penetration. This possibly gave us an overestimated proportion of raped women with anogenital injuries in the Paper III case series. However, the use of physical violence did not differ between those examined vs. those not examined, indicating representative frequency of extragenital injuries included in Paper III.

All of these factors contribute to the assumption that those participating in the three studies are selected and not representative of all assault victims attending the SAC or reporting to the police. The prevalence of the different variables may be affected by this selection bias. However, the study of associations could still give a realistic picture.

6.1.3.2 Information bias/misclassification

This phenomenon denotes erroneous classification or categorization of collected information, that is, addresses the accuracy of the collected data (160). In a small dataset, misclassification of only one case may distort the results. Several levels of misclassification exist in the present studies.

For all of the papers, patients' self-reported information given to health care and/or police may not be completely truthful, for example, the information might be incomplete, false, or exaggerated. Patients may overreport the use of violence, penile

[103] Those with missing information were included in the analysis

penetration, and non-Western, stranger, and more than one assailant to satisfy to the "rape myths criteria" (168) or to obtain sympathy/attention. If over-reporting of stranger rapes were more common among those testing positive than among those testing negative for ethanol, this misclassification may result in an overestimation of the association of stranger rape and positive ethanol test (exposure differential misclassification). Likewise, if those testing positive for BBVs disclosed a history of substance abuse more often than those testing negative, this misclassification may have distorted our results towards a higher OR. In addition, if cases without extragenital injuries were "erroneously" classified by the police as "charges not filed because of insufficient evidence" ("disease" or outcome differential misclassification) more often than those with injuries, this will falsely strengthen the relation between injuries and charge filing (Paper III and the EA).

On the other hand, if the documentation of anogenital injuries were equally wrongly diagnosed both among those cases ending in court and among those dismissed, this phenomenon of misclassification will bias our results towards "null effect" ("exposure" non-differential misclassification). Similar dilution of a potential effect exists if we for some reason under-detected the findings of GHB equally often among those with and without a history of drug abuse ("disease" or outcome non-differential misclassification).

Sexual history could be difficult for some patients to recall or be frank with. For example, patients' false claim to virginity is a misclassification that probably would lead to a higher prevalence of STI among those categorized as virgins, and a lower OR of the association between STI and coital experience (Paper I). However, only one of those classified as coitally inexperienced had a positive finding of CT, thereby rendering this misclassification probably only exceptional.

For Paper II, fear of being blamed for illegal drug use or embarrassment about amnesia regarding the event, may have caused some SAC patients to report that a drug could have been covertly administered to her. Thus, cases of opportunistic DFSA could be wrongly classified as proactive DFSA, and result in an overestimation of the prevalence. In our SAC, however, urine and/or blood were tested for the purpose of

detecting surreptitious drugging only, and the results could not elicit any legal sanctions against the victim. In addition, like in Australia (105), a lower, rather than a higher, prevalence of proactive DFSA was found when the victims themselves addressed the issue, rather than SAC staff or police investigators. It therefore seems that the prevalence of 22% among the group of patients included in Paper II is not an overestimation.

For Paper II, an example of recall bias is the underreporting of drug intake, especially of drugs with long half-lives (cannabis and some benzodiazepines), which might explain some of the unexpected findings of drugs in urine/blood. However, two patients actually admitted self-reported intake of hypnotics (flunitrazepam and zopiclone), but might still have been surreptitiously drugged since we found higher serum levels of the drugs than expected many hours after intake (Table 9, section 5.2.1). Because positive tests for ethanol was in accordance with patients' history of drinking both in Paper II and in a previous study, self-reported history of alcohol use is rather reliable among our SAC patients (169).

By excluding those attending too late for an alcohol/drug test, we may have missed diagnosing some cases of true DFSA. Sophisticated hair-analysis for, e.g., single intake of benzodiazepines (one month in advance), was not available during our study period.

The role of a clinician is to be the patient's solicitor or helper. This deep-rooted aim could hamper objectivity in evaluating the medical findings. There is a risk of overemphasizing the medical findings, for example, a physical injury that is hardly visible, but is reported as painful by the patient. When reading the medical records, we were aware of this limitation and only defined as injuries if documented by sketch or by photo in the records.

6.1.3.4 Regarding missing information

For some of the independent variables studied in the three papers, the number of cases with missing information is substantial. However, when we included those with missing data into the analyses, the results remain unchanged. Still, some effects

may have been over- or underestimated. I have chosen to explore this phenomenon with examples from Paper I, but similar considerations could also be drawn from the two other papers.

Regarding the outcome of whether a patient had an STI or not, missing data may have an impact on our results for some of the variables: for example, for genital examination with a speculum, prior coital experience, and origin of the assailant (Table 18). For genital examination with a speculum, only one patient among those with missing information (3%) was diagnosed with an STI. It is reasonable to believe that

Table 18. Sexually transmitted infections (STIs)[104] and blood borne viruses (BBVs)[105] disclosed at initial visit: Selected variables by presence of STI/BBV (%, prevalence shown) (Paper I)

	STI present, N=35
Variable	**n/total tested (%)**
Genital examination with speculum	
Genital speculum inspection	31/366 (8)
Genital inspection only	3/12 (25)
Missing information	1/34 (3)
Prior coital experience	
No	1/31 (3)
Yes	32/356 (9)
Missing information	2/25 (8)
Assailant origin	
Norwegian/Western	16/245 (7)
Non-Western	12/81 (15)
Missing	7/86 (8)
	Marker(s) of BBVs present[105], N=14
	n/total tested (%)
Prior coital experience	
No	0/27 (0)
Yes	14/334 (4)
Missing information	0/20 (0)
Time since last consensual coitus, n=354[106]	
≤ 2 weeks	5/139 (4)
> 2 weeks	2/135 (1)
Missing information	7/80 (9)

[104] Positive test at initial visit for at least one of the microbes *Chlamydia trachomatis*, *Mycoplasma genitalium*, *Neisseria gonorrhoeae*, *Trichomonas vaginalis*, and/or HSV, and/or clinically diagnosed anogenital warts
[105] Positive test at initial visit for at least one of the serological markers: HIV, hepatitis B and/or C (see text for details)
[106] Those reporting no prior coital experience were excluded

when it is not documented in the medical record whether a speculum was used or not, that the speculum actually was used, since this is standard procedure. This means that the difference between the groups could be larger, that is, results could be underestimated. For prior coital experience, among those 25 with missing information, two patients (8% out of 25) had an STI. It is, however, reasonable to believe that those with no information about this variable had prior coital experience. STI was marginally less common among those with missing information than among those who reported prior coital experience. Hence, we do a minor overestimation of the results. For the origin of the assailant, the missing category is considerable (n=86 or 21%), but equally distributed between the two outcomes. Among those with missing information on assailant origin, we found an STI prevalence in-between the prevalence rates of the other two categories. Still, the difference between those reporting Western vs. non-Western assailant is large. Hence, including those with missing information into the model does not influence our final results regarding this variable.

For the outcome of whether a patient tested positive for a BBV marker or not, the amount of missing data for some of the variables may influence our results: prior coital experience, and time since last consensual intercourse (Table 18 above). As for prior coital experience, none was positive for any BBV marker among those with missing information. It is, again, reasonable to believe that those with no information about this variable have had prior coital experience, hence, a minor overestimation of the difference between the two groups. As for time since last consensual intercourse, for calculating the influence of missing information for this variable, all of those with no prior coital experience were excluded (n=27). Still, information is missing in as many as 23%. We found the highest prevalence of BBVs among those with missing information. We therefore regard those with missing information as having particular characteristics. The high prevalence of BBV markers in the group with missing information could partly be through the effect of substance abuse (see Table 3, Paper I). However, including the missing category in the analyses did not change the difference between the two groups (last consensual intercourse being ≤ or > 2 weeks).

6.1.3.3 Confounding, mediation and stratification

The concept of confounding expresses that the observed association between the independent variable and the outcome actually represents an association between another variable and the outcome, a confusion of effects, or that the effect of the independent variable is admixed with the effect of another variable (160). Mediation refers to the mechanism of a causal relationship: the independent variable influences an intermediary factor which in turn influences the outcome. In multivariable models, it is possible to adjust for some potentially confounding factors, for example by using logistic regression, which we used in this thesis.

In Paper I, this can be illustrated by the fact that being a student was associated with a higher prevalence of STI in the unadjusted analysis. However, after adjustment for age, this association disappeared, that is, the "effect" of being a student on STI prevalence actually was through the effect of age. Hence, age is a confounder in this example. In contrast, the effect of substance abuse on STI prevalence actually increased (and became significant) after adjustment for age. Age is here a special type of confounder called suppresser (170) (Table 2, Paper I).

In the same Paper, substance abuse could also be regarded as a confounder. The effect of unemployment on the findings of BBV markers (Table 3, Paper I) diminished when we adjusted for substance abuse. Obviously, the effect of unemployment on BBV positivity was partly through the effect of substance abuse, that is, substance abuse is a confounder. However, substance abuse could also be an intermediary factor, that is, substance abuse is in the causal pathway between unemployment and BBV positivity. Since in Norway, both hepatitis B and C are more prevalent among subjects injecting drugs, the latter possibility may be more likely.

Confounding could be regarded as a sophisticated method of stratification. In Paper III we adjusted for the time interval from assault to medical examination, hence, regarded this as a confounder for the association between the detection of injuries and charge filing. No change in the association between injuries and legal outcome remained after adjustment for post-assault interval. Certainly, time interval from assault influences the possibility to detect injuries. Even though, whether the best

strategy for the analyses here is adjustment as in logistic regression instead of other kinds of stratification, has not been evaluated.

In Paper II, another strategy was to restrict (stratify) the analyses (of alcohol positive vs. negative) to only those arriving within 12 hours of the assault. This was because ethanol would not have been detectable anyway for those attending later. In Paper III, we also restricted the analyses between injury and legal outcome to those reporting physical violence (for body injury) and anogenital penetration (for anogenital injuries) – assuming a causal relationship between action and injury. However, unknown factors on the causal pathway between injury and legal outcome may be present.

We found a convincing association between the analysis of trace evidence and charge filing. However, Paper III does not give an answer whether the decision to analyze the swabs collected from the women's bodies comes before or after the decision to file charges. It remains unknown whether the investigators chose to analyze the swabs only in cases with a potential for prosecution. Moreover, our study contains no information regarding whether some women refused to have her already-collected SAC swabs sent for analysis by the police.

When studying association with legal outcome in Paper III, variables related to the circumstances of the sexual assault (for example, age and number of suspects, victim – suspect relationship, police interview, and the suspect being previously convicted etc.) might have influenced the legal outcome and could be regarded as confounders. In a South African study, the authors used whether a first witness statement was taken by the police or not as a confounder, since this was regarded as an indicator of the quality of the police investigation (136). This dichotomous variable was included in their logistic regression model searching for the association between medical findings and charges filed. However, for the present study, we did not include any similar variables as a proxy for quality of police investigation. Due to the small sample size in Paper III, additional confounding was difficult to adjust for, but probably there are several, and many are unknown factors.

6.1.3.4 Clinical vs. statistical causal pathways

As a continuation of the concepts of confounding, we need to address some differences in the two ways of thinking about the causal pathways. On the one side is the clinical/forensic approach, and on the other side is the statistical/epidemiological approach. The clinical way of thinking takes signs and symptoms into account for a disease (for example, anal penetration associated with a case of rectal NG). Likewise, the forensic physician evaluates whether external mechanisms could have caused an injury (for example, anal penetration associated with anal injury), and often a causal relationship could be established. However, this causal relationship cannot be established when analyzing retrospectively collected data material from records. The epidemiological/statistical approach is to test quantitative data and look into mathematical relationships. This technique evaluates whether there is a statistical association or a probability that the variable under study could be associated with (but not causing) the outcome.

Some examples of the differences between forensic and statistical thinking about causal relationships could be used to illustrate. For example, most anogenital injuries found in cases of sexual assault are superficial and transient. We did not find any statistical association between this finding and legal outcome. However, occasionally anogenital injury documentation could be crucial for a case to proceed in court. Unfortunately, our study was not able to identify whether such evidence alone was used in single cases. Likewise, in some individual cases, DNA may be of invaluable evidence for the case, but when the system is viewed as a whole, no obvious association was found.

6.1.4 Generalizability of the findings not related to errors

As stated in section 6.1.3.1, many victims of sexual assault do not seek medical care, and our results are therefore not necessarily applicable to victims of sexual assault in general. Moreover, generalization of our findings to other countries should be done with caution. Both the populations subjected to sexual assault and those seeking help may differ considerably between countries, and the medical indications

for performing the different examinations and laboratory testing may vary. Differences in the organization and financing of health care may reduce the validity of our findings in countries with lower income and lower access to expensive technology. However, similar findings of STI-prevalence, toxicology results, and injuries as those presented here have been found in other studies from Western countries, increasing the probability of our findings being representative for these populations.

Different thresholds for police reporting, women's rights and gender equality issues, as well as different legal systems and attitudes among investigators/prosecutors, could diminish generalizability of the findings in Paper III and the EA outside the Nordic countries. Similar studies should therefore be performed in countries with a minor degree of gender equality as well.

6.1.5 Reliability and validity

6.1.5.1 Microbiology and toxicology test

Regarding positive STI/BBV laboratory tests, all tests were repeated with the same or an alternative test method according to recommendations (cf. details in section 4.5.1.4 and in the Method section in Paper I). In case of urine samples testing positive on drug screening, the corresponding blood samples were analyzed to confirm the results (cf. section 4.5.1.4 and Method section 2.4 in Paper II).

6.1.5.2 Anogenital injuries

Regarding the clinical findings, for example, evaluating anogenital injuries may be difficult and is partly dependent on the examiner's experience. One study has shown that the more experienced physicians were less apt to classify findings as genital injuries (171). This could result in over- or underestimating the prevalence of injuries in our studies. Peer-reviewing all injuries present would improve the interpretation, and since 2008, the Trondheim SAC staff have systematically performed such quality control. Hence, at least one physician, in addition to the examiner on duty, has examined the colposcopic photos.

6.1.5.3 Sensitivity and specificity of swabs and urine samples (Paper I)

Different sensitivity exists for both CT- and MG-detection by FVU versus swabs collected from the urogenital area. According to three studies from our hospital's laboratory, FVU seems to be as sensitive as vaginal swabs for the detection of CT, while FVU seems to be somewhat more sensitive than swabs for MG detection (172-175). The specificity is generally high for all sampled materials (172).

In Paper I, altogether 383 patients had microbiological swabs collected from the urogenital area[107], while 81 had FVU[108] tested. Regarding urogenital CT, all positive tests were from urogenital swabs, except for two tests performed in FVU only. For urogenital MG, only one tested positive, and positive in FVU only (negative in urogenital swab). Since vaginal swabs should be as sensitive as FVU for the detection of CT, we do not expect the differences in detection rate between the different samples to influence our results to a large degree. However, since only a quarter of the samples were tested for MG, and more than half of these were not examined in FVU, MG is probably underdiagnosed in our series.

Regarding Paper I, urogenital swabbing was the method of choice for the whole period of time (2003 – 2010). However, since we became more aware of the possibility of detection of CT from different locations (FVU, anorectal area and pharyngeal area) during that period, an increasing load of tests collected from locations other than the cervix were submitted beyond the period. In addition, for increasingly more patients, we collected samples from more than one location. However, except for two cases, all positive tests were collected from the urogenital area (incl. FVU); one sample testing positive for CT came from the pharynx and one for MG from the anus. Others have found that the sensitivity increases considerable when combining test materials (176).

6.1.5.4 NG culture compared to PCR (Paper I)

The gold standard for NG diagnosis has been culture. NG is a fastidious bacterium, needing optimal sampling, transport medium, transport time, and

[107] n=377 tested for CT/MG (TV/HSV) and additionally n=6 for NG only
[108] All, except one tested for CT, additionally one tested for MG only

transport conditions to allow for high sensitivity culture. As for other STIs (for example, CT and MG), NAAT has been developed for NG detection as well. During 2013, the St. Olavs Department of Microbiology has started to test for NG by using NAAT instead of culture. One Norwegian study, on the sensitivity and specificity of NG-testing when using culture vs. NAAT, has found that the sensitivity of culture was only 71% vs. 100% for NAAT (177). Especially for pharyngeal and rectal samples, the sensitivity was significantly lower for culture than for NAAT. However, the negative predictive value for NG culture was 95% (and the specificity and positive predictive value was 100%).

In Paper I, we had 300 cervical samples cultured for NG, while only 53 and 61 samples were collected from the anorectal and pharyngeal area, respectively. Since the microbial laboratory is situated at the same hospital, transport of samples was easy and rapid. It is reasonable to assume a low number of false negatives, although limiting our NG detection to culture might have resulted in this infection being underdiagnosed.

6.2 Discussion of the results

This thesis has critically explored some findings obtained during the acute medical examination of female victims of sexual assault in Norway. Until now, STIs and toxicological findings among Norwegian sexual assault victims seeking help have not been described. Issues regarding assault-transmitted STIs and considerations of proactive DFSA prompted us to explore the cases further, which has only been done in a few earlier studies. When studying police-reported rapes, our findings are in accordance with those made by the Oslo SAC, that the police's use of medical information is limited. Beyond that, it has added some new aspects of the impact of medical information in rape investigation in Norway, for example, the impact of extragenital findings on charge filing. Each of the three different topics dealt with in this thesis will be discussed in the following sections.

6.2.1 Sexually transmitted infections (Paper I)

This study has added to our knowledge of STIs in victims of sexual assault in a

Nordic setting. We have described the relatively low prevalence of STI/BBVs in a Norwegian SAC, corresponding to the knowledge that such infections might be less frequent than in many other countries. Norwegian assault victims were rarely found to be infected during the assault. Our findings will be compared to what have been described by others in sections 6.2.1.1 – 6.2.1.4.

6.2.1.1 Prevalence of STI/BBVs

The results from Paper I are presented in Table 21 in a similar way as for the comparable studies discussed in section 2.3.1 (Tables 2 and 3). We have described the STI/BBV prevalence among those presenting to a hospital SAC within one week of the assault. Only four recent studies describe the STI findings from the acute examination (41, 65, 67, 74). Except for in the U.S. study regarding adolescent sexual assault victims (65), we found the lowest prevalence of "any STI." Our CT prevalence of 6% was comparable to the only U.K. study reporting STI-prevalence "shortly" after the assault and to the U.S. adolescent SAC study (65, 74), a little lower than in the Belgian study (67), but much lower than the prevalence of 29% that was found among the South Korean SAC patients (41). None of the other studies from Table 2 has reported MG prevalence, so this is the first study to add knowledge about this newly diagnosable sexually transmitted agent.

We did not find any case positive for NG or TV, reflecting the low prevalence in the Norwegian general population. In two recent western SAC studies, only 1 – 2% of patients had NG (65, 74), while as many as 6% of those attending the South Korean SAC tested positive (41). Even if the latter study used PCR for testing (see section 6.1.5.4), Norwegian surveillance data, which includes some NG PCR tests, show low prevalence of the microbe as well. This emphasizes the higher risk of infection in other parts of the world. Correspondingly, more than one STI was found in 3% in the South Korean study, while we only found this in one single patient (0.2%). An audit among 19 U.K. STD-clinics reported that as many as 6% of victims of sexual assault had more than one STI (69). However, the authors did not include details of the microbes found, and only one third of the patients were tested within two weeks of the assault. A U.K.

Table 21. Sexually transmitted infections (STI) and blood borne pathogens (BBP), and post-exposure prophylaxis offered (Paper I) (cf. Table 2)

First author, publication year, country	Sample size, setting and, years included, design	STI prevalence, at initial visit (at presentation), No. testing positive/no. tested (%)	BBP prevalence[109] at initial visit (at presentation), No. testing positive/no. tested (%)	Post-exposure prophylaxis: antibiotics, hepatitis B vaccination, and HIV PEP (offered/received) (%)	Sex, age, time from assault, test method, follow-up
Hagemann, 2014, Norway (Paper I)	N=412 attending a SAC; 2003 – 2010; retrospective	Any STI: n=35 (8%); NG: 0/304; CT: 25/393 (6%); MG: 2/106 (2%); TV: 0/58; anogenital warts: 8/412 (2%); HSV: n=1 (of the 2 tested); > 1 STI: n=1 Positive for both MG and HCV, n=1	HIV: 0/374 HBsAg: 0/362 HBcAb: 7/344 (2%) HCVAb 9/330 (3%) syphilis: 0/213 n=2 tested positive for both HBcAb and HCVAb	Antibiotics: 374/412 (91%); HBV[110]: 80/412 (19%); HIV-PEP: 11/381 (3%)	All female Median age 21 years (12 – 61) Median 12 h from sexual assault (1 – 165 h) Urine/swabs PCR-test (CT, MG, HSV) Swabs culture (NG, TV) Anogenital warts clinically diagnosed Follow-up rate 195/412 (47%)

[109] Excluded HBsAb results (immunity)
[110] Offered to 41% of the patients attending during 2008 – 2010, reflecting a change in the guidelines

study from the 80s reported a frequency of more than one STI of as high as 15%, again due to the higher prevalence of both NG and TV at that time in contrast to nowadays (85).

We found no positive tests for HIV, which is in accordance with many of the other recent studies presented in Table 2 (41, 65, 66, 68, 73), but contrasting the findings from South Africa, where as many as 14% of the SAC patients tested positive for HIV at the initial visit (42). None of our patients currently had hepatitis B infection (all negative for HBsAg). However, 2% had gone through this viral infection during their lifetime, testing positive for HBcAb. When excluding among the HBV markers those testing positive for HBsAb only (indicating immunity after vaccination), the proportions testing positive for HBV markers in other SAC studies are similarly low (41, 43, 67, 73, 74). Hepatitis C is mostly transferred through contaminated syringes or blood, whereas sexual transmission is less frequent (178). A total of 3% of our SAC patients tested positive for HCV markers. Only 3 other SAC studies report prevalence of this infection. All tested negative in the two studies of adolescent patients (65, 73), while 4% tested positive in the Belgian study (67). The latter consisted of older patients with more mixed ethnic background. Syphilis was not found in any of our patients tested at the initial SAC visit, which is in accordance with other recent SAC studies (41, 43, 65, 67, 73, 74).

6.2.1.2 Post-exposure prophylaxis

We offered antibiotic prophylaxis to more than 90% of our patients attending within a week of the assault. This is the highest level we have found among all SAC studies, except for in Israel where all victims were offered antibiotics (44). Hepatitis B immunization was increasingly offered to our SAC patients throughout the study period, see Table 21 for details. In four U.K. studies, HBV vaccination was offered to more than half of those patients attending shortly after the assault (66, 68, 69, 72). We only offered HIV-PEP to 3% of our victims attending within 72 hours of the assault, whereas corresponding numbers from the U.S., Kenya and Brazil were 63 – 84% (43, 45, 65). The South African HIV-prevalence authors claimed offering HIV-PEP to a

proportion of the SAC patients tested, but did not include numbers (42).

6.2.1.3 Assault-transmitted STI/BBV

Altogether, we could conclude that two patients in our study contracted the infection during the assault. One of those with no prior coital experience tested positive for CT, while another patient got an HSV infection.

Only some older prospective and retrospective studies have estimated the risk of different infections following sexual assault (see section 2.3.1.3). However, no recent studies have tried to give similar estimates for assault-transmitted STIs among non-virgins, since excluding pre-existing infections are almost impossible. Still, patients with previous coital experience could become infected during the assault.

As stated, the Trondheim SAC offer as a routine one-dose azithromycin prophylactic treatment at the initial post-assault visit. Among those re-tested for an STI within 6 weeks, one patient who initially tested negative, subsequently tested positive for CT at the follow-up. Similarly, in a U.S. study, even if all patients diagnosed with an STI at the follow-up consultation had received prophylactic antibiotics at the initial visit, NG and CT were each detected in three cases (78). Some of the victims may not be able to ingest the medications offered, might have been re-infected through consensual sex, or might have been infected with resistant bacteria.

Re-screening for serologic markers in our study revealed no new cases positive for HIV or HBcAb, while three tested positive for HCVAb during the follow-up. Each of these three patients had additional risk factors for HCV infection. Re-screening for serologic markers of HIV and/or syphilis must be performed after at least 3 months, while for hepatitis B and/or C diagnostics, at least 6 months should have passed for a reliable negative test. Only one recent SAC study reports follow-up testing for BBVs of as long as 3 months (68). None of the patients had seroconverted to HIV positive. However, with such a long incubation period, intervening BBV transmission is possible and further complicates our possibility to interpret assault-transmission of BBVs.

6.2.1.4 Characteristics associated with the detection of STIs/BBVs

Both STI and BBV-detection was associated with patient age, although in different patterns. We found a strong association between increasing patient age and positive test for at least one BBV marker. Similarly, no patients < 20 years of age were found to test positive for BBVs in an older U.S. SAC study (79).

In contrast, STI prevalence was highest among the 16 – 19 year-old patients. When looking into CT prevalence only, a similar pattern was found (Table 8 in section 5.1.1): highest among the 15 – 19 year olds (11%), followed by those aged 20 – 24 years (5%). In the study from the South Korean SAC, the highest proportion of CT-positive tests was among the 15 – 19 year olds, followed by those aged 10 – 14 years (41). The proportion of women diagnosed with genital chlamydial infection after the age of 15 – 19 years has been shown to decrease with age in several different settings and studies (159, 167, 179, 180).

As shown in Figure 14 below, the Trondheim SAC CT-prevalence was lower than

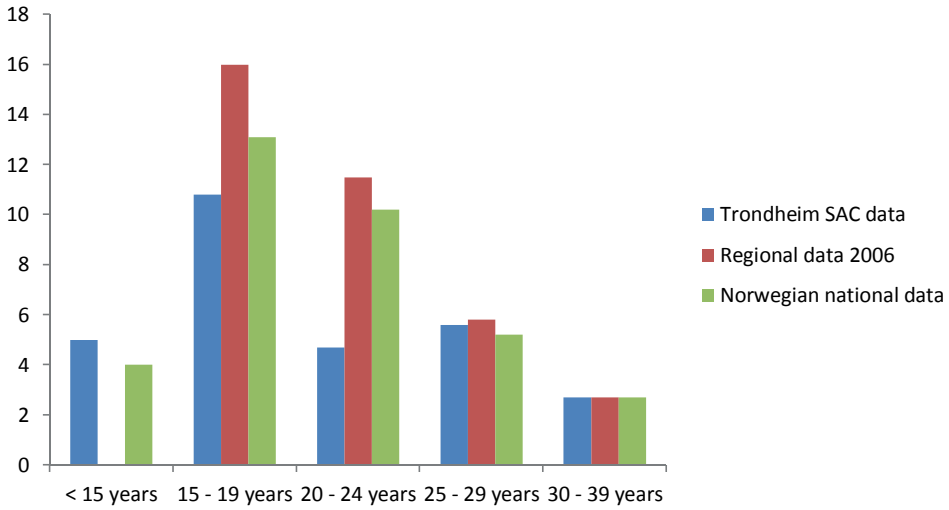

Figure 14 Proportion with positive tests for CT in % of those tested in 3 different clinical settings: Data from the Trondheim SAC, other clinical data from St. Olavs Hospital (180), and data from national Norwegian surveillance (167)

in comparable clinical populations. According to Norwegian national surveillance data among the women tested, the highest proportions testing positive for CT were found in the 15 – 19 years-old-group (13%), followed by those aged 20 – 24 years (10%) (167, 181). According to a clinically based study from the catchment area of our SAC, the prevalence of CT in 2006 was as high as 16% among the youngest women (15 – 19 years) and 12% among those aged 20 – 24 years (180). Similarly, in other studies, prevalence of STI among SAC patients has been compared to the prevalence among other gynecological or STD-clinic patients, and found to be lower (80, 87) or "no greater" (71). This is in contrast to the sexual assault victims' assumed higher risk of STIs.

We could also compare the CT prevalence reported in Paper I with that of the general Norwegian population. A prevalence of around 2% has been reported among female volunteers younger than 25 years of age (182-184), except for in a recent survey among adolescents in the north of Norway, where as many as 7% of the girls tested positive for CT (185). Unfortunately, only a few studies have been conducted regarding BBV-markers in the general Norwegian population. The prevalence of HBV-markers has only been presented as a conference proceeding (186). In the Oslo Health Study, more than 5,000 women aged 30 – 75 years were tested for HBV markers: 5% tested positive for HBcAb, while only 0.3% were positive for HBsAg, both values a little higher than found in our SAC study. However, for HCV markers, two Norwegian antenatal surveys reported a prevalence of HCVAb of only 0.2 – 0.7% (187, 188), which is considerably lower than HCV prevalence among our SAC patients. The latter is in contrast to what was found in South Africa, where the prevalence of HIV positive test among SAC patients was less than half that found in an antenatal HIV surveillance survey (42). Different age distribution might be one reason for the disagreement.

We found associations between positive tests for STI or BBV and a history of alcohol or drug abuse. This contrasts to what was found in a U.S. study, where patients with a history of drug abuse (and/or mental illness) did not have a higher rate of infection than others (88). Drug abuse might induce risky sexual behaviour, thereby giving higher chance of STI infection. In addition, according to both Norwegian and

Australian authorities, transmission of hepatitis B and C among people not originating from high-endemic areas occurred predominantly through injecting drugs (189, 190).

The only assault and assailant characteristic associated with a higher prevalence of STI was non-Western origin of the assailant. The recent South Korean SAC study neither found any association between ejaculation during the assault and STI positivity (41). Some have described that anal penetration was associated with a case of rectal NG (85). We did not find any SAC studies reporting on the association of anal penetration/anogenital injury and BBV infections. This might be difficult to prove, although anogenital injury may facilitate the transmission of these viral infections (191, 192). In a U.K. case report, vaginal penetration by more than one assailant probably caused transmission of hepatitis B to the victim during the assault (96). To conclude, population-based global data have found associations between sexual intimate partner violence and risk factors for HIV infection (193, 194).

Regarding the clinical variables and STI, those not undergoing speculum-assisted examination at our SAC, had a 4-fold higher prevalence of STI. This is in contrast to a U.K. SAC study which found a higher prevalence of STIs in patients completing a speculum examination (73). On the other hand, studies from non-SAC settings have found higher sensitivity of MG and CT when other test materials than cervical swabs are used in the diagnosis, like FVU and vaginal self-test (172, 173, 176, 195, 196). Finally, the finding of sperm at our SAC had no association with STI positivity, contrasting to what was found in a U.S. study, where the majority of those with new STI diagnosed at follow-up had sperm detected at the initial SAC visit (88).

6.2.2 Toxicological findings and DFSA (Paper II)

This study has added to our knowledge of the use and findings of alcohol and drugs in Norwegian victims of sexual assault, as well as to map out the prevalence of suspicion of proactive DFSA. We have found that alcohol was the dominant drug in urine/blood samples from the SAC patients, and that no cases of DFSA could be verified unequivocally. Our findings will be compared to what have been described by others in sections 6.2.2.1 – 6.2.2.3.

6.2.2.1 Ethanol and drugs findings among our SAC patients

The results from Paper II are presented in Table 22 below in a similar way as for the comparable studies discussed in section 2.3.2 (Table 4). The proportion of our patients testing positive for at least one drug, including ethanol, is in accordance with findings from the other studies cited in section 2.3.2.3. However, the proportion testing positive for ethanol is rather high and the proportion testing positive for other drugs is correspondingly low, which also is in accordance with the findings from the other Nordic surveys of sexual assault victims (106, 124, 127). The differences are mostly due to the higher proportion of cases testing positive for illicit drugs (cannabis, cocaine, etc.) in the North American, U.K., and French studies (113-116, 118-122, 125, 128).

We did not screen for other drugs, like antidepressants, antipsychotics, sedating antihistamines, or non-sedative therapeutic drugs. We could therefore not exclude drugging with such substances. This makes comparisons with those studies reporting such testing difficult, for example, the Australian and the Dutch (105, 126).

Only half of the victims came within 12 hours of the assault. Hence, for those attending later, we could not detect drugs with lower urine detection time than 12 hours, for example, GHB and ethanol. We restricted the analyses to only those tested within 12 hours, and found that the distribution of ethanol levels, both at time of sampling and estimated at time of assault, was similar to what has been reported in studies from Europe and Australia (102, 105, 123, 124, 126, 127, 135).

6.2.2.2 Suspicion of proactive DFSA; findings compared to voluntary intake

We explored in detail those 57 patients who suspected proactive DFSA. In five of these patients, we unexpectedly found a sedative drug, which means the drug was not reported as having been ingested voluntarily. One patient tested positive for clonazepam and another four for diazepam/oxazepam. Since these five patients all had a history of anxiety/drug abuse, we did not find it justified to verify proactive DFSA. This is in accordance with the five prior studies mentioned in section 2.3.2.4. Although several cases reported a suspicion of proactive DFSA and a proper investigation had been performed, a conclusion of proven proactive DFSA could only be made in a small

Table 22. Summarized toxicological findings among victims of sexual assault and specifically in cases of drug-facilitated sexual assault (DFSA) (Paper II) (cf Table 4)

First author, publication year, country	Sample size, setting, years included, design	Method, time from assault	Number and/or percentage of the sample where each drug was detected				Voluntary intake vs. findings, strength and limitations
			Illicit	Sedatives	Alcohol, BAC[111] at assault	Other	
Hagemann, 2014, Norway (Paper II)	n=264 attending a hospital SAC; 2003 – 2010; retrospective	Urine and blood. Median time from sexual assault 13 h (1 h – 16 days)	Cannabis 5%; central stimulants 5%	Opioids 4%; benzodiazepines 12%: oxazepam 7%; clonazepam 3%, diazepam 3%; flunitrazepam 1%; nitrazepam 1%; zopiclone 2%	Alcohol 45% Mean BAC at time of sampling 1.2 [0.2 – 2.8]; mean estimated BAC at time of assault 1.9 [0.4 – 4.0]	At least one drug in 59%: alcohol only in 40%; alcohol + other drug(s) in 5%; other drug(s) only 14%	Strengths: contains patient and assault characteristics. Gives results according to reported intake. Unselected material Limitations: Retrospective chart review. Small sample size

[111] BAC (blood alcohol concentration) in g/L (‰), mean and range [ ] or SD (standard deviation) given

fraction (105, 106, 118, 122, 125).

6.2.2.3 Ethanol and drug positivity and certain characteristics

We did not find any association between age and alcohol positivity or between age and estimated BAC at time of assault. This is in contrast to what was found in the large Swedish case series (124, 127). However, older age was associated in our study with a positive test for at least one drug other than ethanol, which has also been described by others (128). Our study did not have sufficient power for a detailed analysis of each of the specific drugs by age.

Those testing positive for ethanol in Paper II more often reported a public place of assault and a stranger assailant. In addition, high estimated BAC at the time of assault was associated with the assailant being a stranger. In contrast, a positive drug test had no association with the relationship to the assailant, but was associated with serious extragenital injuries. Contrasting our findings, as referred in section 2.3.2.6, in a U.S. SAC study, private place of assault was associated with a positive test for alcohol, whereas those testing positive for drugs more often were raped by a stranger (128). In Norway, alcohol is the recreational drug of choice used by a high proportion of the population, whereas other illicit or medicinal drugs are restricted to certain subgroups. In the U.S., however, even in some years back (1997 – 1999), illicit drug use seemed to be more common, at least among those attending this particular U.S. SAC. Different rates of attendance and a selection of those subjected to stranger rapes, could, however, partly explain the differences.

This is the first study to demonstrate an association between high estimated BAC at the time of assault and a suspicion of proactive DFSA, even though others have stated that in many cases the amount of voluntarily ingested alcohol probably is underestimated (135), particularly when taking into account the victim's age and drinking experience (124). Still, there is also a possibility that drinks actually could have been spiked with alcohol by others (124).

We found that patient background characteristics, like mental health problems/drug abuse and unemployment, were associated with a positive test for at

least one drug other than ethanol. However, this has not been described in any previous SAC studies. Even if those drugs tested for are not the first drugs of choice in the treatment of mental health problems, use of anxiolytics/hypnotics is quite common among women with mental health problems (197).

6.2.3 Injuries and analysis of trace evidence (Paper III and expanded analyses)

These studies have added to our knowledge of police-reported rapes and attempted rapes in Norway. We have pointed out that only a small and a steadily decreasing proportion of police-reported rape cases were taken to court. More than half of the cases were dismissed because of insufficient evidence. Among the cases taken to court, a higher proportion had moderate/serious body injury and more DNA analyses were performed. Our findings will be compared to what have been described by others in sections 6.2.3.1 and 6.2.3.2.

6.2.3.1 Legal outcome among the cases of rape and attempted rape

We found a considerable attrition of the rape cases through the Norwegian legal system. As shown in Figure 12, section 5.3.4, a charge was filed in 16% of cases during the period 1997 – June 2003, but the rate was as low as 8% for the period July 2003 – 2010, ending with a charge filing rate of 11% for the total period in the EA. The latter proportion is the lowest of all the other studies commented in section 2.3.3.

6.2.3.2 Injury and trace evidence – association with legal outcome

The results from Paper III and the EA are presented in Table 23 below in a similar way as for the comparable studies discussed in section 2.3.3 (Table 6). The prevalence of extragenital injuries (of 49 and 56%, respectively) in our studies is similar to that found in many of the studies cited in section 2.3.3.2 (19, 81, 89, 136-144, 146, 147). The documentation of moderate/severe injury had a greater impact on charge-filing than no or minor injury. However, the association was only borderline significant. Significant association between moderate/severe injury and charge filing has been shown in two North American studies (139, 140), but refuted in others (89, 137, 141, 144). Actually, in South Africa, researchers found a high number of cases where an

Table 23. Summarized medico-legal evidence's relationship to legal outcome. Results from Paper III and the

First author, publication year, country	Sample size, setting, years included, design	Medico-legal findings[112]		
		Extragenital injury	**Anogenital injury**	**Biological samples**
Hagemann, 2011, Norway (Paper III)	n=101 female victims ≥ 16 years of age; 87% examined within 72 h; hospital SAC; data from medical and police records; 1997 – 2003; retrospective	Any extragenital injury 49%: minor 39%; moderate 5%; serious 5%; ≥ 4 lesions 15%	Any anogenital injury 14%; > 1 injury 8% (range 1 – 10 number of injuries); vestibule 5%; post. forchette 3%; perianal 3%; perineum 2%; tear/laceration 11%; abrasions 3% Erythema and tenderness excluded, gross visualization	Vaginal, anal and/or oral samples (swabs) collected 88%; trace evidence analyzed 30%; sperm detected in forensic lab and/or SAC 16%; DNA typing 18%; male DNA found 9%; DNA matching suspect 5%
McLean, 2011, UK (147)	n=500 sexual assault victims ≥ 18 years; claiming penile-vaginal rape by one assailant; attending a SAC within 48 h of the SA; data from forensic client notes incl. legal progress info; 1997 – 2001; retrospective	Extragenital injury 72%	At least one genital injury 23%; 36% of these had > 1 injury. Location: 61% in post. forchette; 33% labia; 10% vagina; 9% urethra; 8% hymen. Type: 10% laceration; 10% abrasion; 7% bruise	NA
Hagemann, 2014, Norway (The EA[113])	n=324 female victims ≥ 16 years of age; 87% examined within 72 h; hospital SAC; data from medical and police records; 1997 – 2010; retrospective	Any extragenital injury 56%: minor 48%; moderate 6%; serious 2%; ≥ 4 lesions 27%	Any anogenital injury 22%; > 1 injury 13% Erythema and tenderness excluded, gross visualization and colposcopy used[114]	Sperm detected at the SAC: 20%

[112] Emotional presentation reported in Paper III but not presented in the table. Emotional presentation not reported in McLean *et al*

[113] Expanded analyses, included in this thesis only

[114] In the period 1997 – 2003, only gross visualization was used; during 2003 – 2007 and after 2008, colposcopy was used in 22% and 7

expanded analyses for this thesis, and from one other recent study (cf. Table 6)

Legal outcome	Relationship of medico-legal evidence to legal outcome	Limitations and strength
Charges filed 18%; conviction set 12% (prison and preventive supervision); no suspect identified 20%; charges not filed 56%; no crime 6%; withdrawal 1%	Presence of minor (OR 2.2, 95% CI 0.6 – 8.0) and moderate/serious extragenital injuries (OR 3.7, 95% CI 0.7 – 19), absence of anogenital injuries (OR 1.4, 95% CI 0.2 – 7.6) and presence of more than one anogenital injuries (OR 1.8, 95% CI 0.3 – 11) not associated with charge filing. Trace evidence analysis associated with charge filing (OR 13, 95% CI 2.4 – 66), but the findings of spermatozoa (OR 1.7, 95% CI 0.3 – 9.8) was not. Detection of victim-suspect DNA match ended in a charge in four of five cases	Limitations: Retrospective, single jurisdiction, small sample size Strengths: Detailed, descriptive information, incl. info on DNA matching, multivariable model
Trial commenced 15%; conviction 6%; acquittal 5%; lack of evidence 10%; allegations withdrawn before trial 25%; 33% with missing legal outcome	No significant differences in the proportions with genital injuries between those with different legal outcomes (p=0.59), although genital injuries were more common in cases which resulted in a conviction (34%) vs. other outcomes (21%) (p=0.08). There were more genital injuries in cases pursued (i.e., charge filed) (32%) vs. cases dropped (21%) (p=0.2)	Limitations: Retrospective review, only two thirds of the cases had known legal outcome, single jurisdiction, only focused on genital injuries, bivariable statistics Strengths: Detailed, descriptive information of genital injuries, studies association of genital injury on different levels of legal outcome
Charges filed 11%; no suspect identified 20%; charges not filed 56%; no crime 10%; withdrawal 1%	Presence of moderate/serious extragenital injuries (OR 2.8, 95% CI 0.9 – 8.6) was borderline significant associated with charge filing. The presence of minor extragenital injury (OR 1.2, 95% CI 0.5 – 2.7), absence of anogenital injuries (OR 1.4, 95% CI 0.5 – 3.8) presence of more than one anogenital injuries (OR 1.0, 95% CI 0.3 – 2.8), and the findings of spermatozoa at the SAC (OR 1.6, 95% CI 0.7 – 3.9) was not associated with charge filing.	Limitations: Retrospective, single jurisdiction, rather small sample size Strengths: Detailed, descriptive information, using a multivariable model

78% of the cases, respectively

arrest was made even if no injuries were documented on the victim (136).

Anogenital injury was found in only 14 and 24% of the victims in Paper III and the EA, respectively, which is in the lower range of results reported in other similar studies (19, 81, 89, 136, 138-147). In the first study period 1997 – 2003 (Paper III), injuries were diagnosed by gross visualization only. After 2007, however, we used colposcopy in a proportion[115] of the cases. Most of the other studies mentioned in section 2.3.3.2 documented anogenital injuries by gross visualization. In contrast, many U.S. SACs include additional diagnostic equipment like toluidine blue staining and colposcopy (198-202) in diagnosing anogenital injuries among adult and adolescent women. These SACs often report high proportions of the patients with anogenital injuries. Another reason for disparity is that classification of the findings as injuries differ between studies. Our recorded scarcity of such injuries could be due to us including as anogenital injuries only tears, abrasions, and bruises (ecchymoses/petechiae), and excluding redness and/or swelling due to their unspecific and subjective nature. This is in contrast to the TEARS classification (tears, ecchymoses, abrasions, redness and swelling) introduced by U.S. authors (203). Those recommending this as a guideline acronym for diagnosing anogenital injury report higher rates of anogenital injuries (139, 161, 201). However, low prevalence of anogenital injuries could also be due to less penetration and less violence used by assailants in Norwegian rape cases, although this assumption seems less likely.

Anogenital injury was neither associated with charge filing in Paper III, nor in the EA, which has been confirmed by others (140, 143, 145). However, anogenital injury alone was significantly associated with charge filing in a U.S. study using gross visualization and including only bruises, abrasions, and lacerations (144), whereas more than one site of anogenital injury was associated with charge filing in another U.S. study using colposcopy and toluidine blue staining for diagnosis, and including redness and swelling as an injury (139). The more specific "genital injury with a skin tear" (included abrasion, bleeding or scarring), a definition probably used to indicate a

[115] In the period 2003 – 2007: 22%, after 2008: 78%. When colposcopy were used, 37% had anogenital injuries documented

more serious genital injury diagnosed by gross visualization, was associated with conviction in the more recent South African study (136).

We found that almost 90% of the victims had trace evidence swabs collected from their skin or mucosal surfaces. However, only in 30% of cases was the collected trace evidence sent for analysis by the police. This is lower than reported in two of the recent studies referred in Table 6 (136, 146) and also lower than in another Norwegian study with record data from the late 90s (148). The Norwegian National Forensic Laboratory found spermatozoa in 16% of the cases, which is in the lower range of frequencies reported by others (19, 81, 89, 137-143, 146). DNA was matching a suspect in only 5% of the cases included in Paper III, which is lower than what has been found in other Nordic studies (146, 148).

The only medico-legal finding significantly associated with charge filing in Paper III was the analysis of the collected trace evidence. We explored these cases in detail (Table 15 in section 5.3.2). Surprisingly, we did not find that more analyses were performed when the assailant had a more distant relationship to the victim. However, we found that self-reported penetration and an interval from assault to medical examination being ≤ 24 hours were borderline significant with trace evidence analysis. In a study from the Oslo SAC, similar findings were reported. Here, fewer analyses of the victims' samples were performed if the reported crime was coded as a rape (vs. attempted rape) (148). The same pattern was found if the venue was within the assailant's area. We did not find any association between the documentation of spermatozoa and charge filing, as confirmed by others (89, 138, 140).

In the five cases showing a DNA-match between swabs collected from the woman and the suspect, a charge was filed in four cases, while in one case evidence of rape was considered insufficient (Paper III). Among the four cases where unidentified male DNA was found on swabs from the woman, in three cases evidence was considered insufficient, while one case was dismissed because of unidentified suspect. In the South African study, the DNA report more often led to an acquittal when the profile did not match that of the suspect (136). In addition, a match did not secure conviction, since in one case the suspect was acquitted even if the DNA profile

matched. In Denmark, a DNA match was found in a higher proportion of the cases ending in conviction vs. those ending in acquittal (26% vs. 18%); however, the association was still not significant (146). Finally, in an Australian forensic laboratory, no trace evidence was analyzed if the suspect had admitted sexual intercourse with the victim. If analyzed, DNA evidence was associated with conviction in the prosecuted rape cases (204).

6.3. Clinical and forensic implications

6.3.1 Sexually transmitted infections (Paper I)

This study documented that CT prevalence among sexual assault victims was lower than in the comparable clinical population. Differentiating STI transmitted during assault from pre-existing STI is difficult, but the clinician could reassure patients about the rather low risk of testing positive for an STI after sexual assault in Norway. Patients' age (lower for STI and higher for BBV) and a history of substance abuse could indicate higher risk for a positive test, thereby indicating a need for closer follow-up. Of the assault characteristics, only assailant of non-Western origin was associated with diagnosed STI. Other assault characteristics (for example, more than one assailant, and anal penetration) should guide the clinician's decision about when to initiate prophylactic anti-viral treatment, like HBV immunization and HIV-PEP. However, our study did not include follow-up of a sufficient number of patients during a sufficient time interval after the assault, to evaluate this guideline regarding sexual assault victims.

Those not undergoing speculum-assisted examination had a higher prevalence of STI. This should be borne in mind when testing adolescents or other women not accepting an invasive gynecological examination. A speculum examination is, however, useful in differentiating between hemorrhage from the cervical orifice or from a vaginal injury as well as for proper trace evidence collection by means of cervical swabs (sperm/DNA).

Because of routine antibiotic treatment, a follow-up test probably could not catch an assault-transmitted CT-infection in case of a negative test at the initial visit.

Hence, follow-up in our routine clinical practice will probably not disclose any extra information regarding CT detection. However, if untreated patients are offered only a second visit for testing two weeks later at an STD clinic, for example, the psychological burden of waiting for symptoms of a potential infection must also be taken into account. According to other studies, follow-up rates after sexual assault are low (67, 68, 70, 74, 75, 78). Even prospectively designed studies planned to investigate whether patients are infected after sexual assault have a follow up rate of only 53 – 75% (82, 88).

The issue of offering antibiotic prophylaxis to all SAC patients is discussed in a U.K. paper with similar prevalence of STI as in our study (75). They found that a one-dose regimen of azithromycin was acceptable to the patients. Other authors have reported that almost all of the rape survivors they saw preferred prophylactic treatment to returning to the clinic for additional testing (94). On the other hand, if a multiple-dose antibiotic regimen is to be applied, we may reconsider our routines of prophylactic treatment after sexual assault. The disadvantages of using bacterial prophylaxis are the possibility of unnecessary treatment and the reinforcing belief that there was a high risk of infection, which in itself may raise levels of anxiety (205).

The two STI positive patients in our study who probably contracted assault-transmitted infections nevertheless did not report their assaults to the police. According to the Norwegian penal code (section 2.1.2), transferring a sexually transmitted infection to somebody during a rape increases the legal punishment. For this purpose, one needs evidence that the victim tested negative and the assailant positive before the assault. Even if both are testing positive, she might have transferred it to him during the assault. In selected cases, sophisticated techniques could be used to prove similar genetic subtypes of the microbe (for example, of CT and NG), but evidence is less valid than that of a DNA analysis. However, in the very young victim, matching subtypes could be used as indication of assault-related transmission, and has been tried in a court of law in Norway.[116]

WHO and U.K. guidelines do not encourage testing for STI at the initial SAC visit

[116] Personal communication, Arne K. Myhre and Svein A. Norbø

(61, 63). However, the Canadian Public Health Agency recommend such baseline diagnostic STI testing (206). In my opinion, sexual assault examination is an important opportunity to diagnose any STI, for the identification of the distribution of STIs, and for reason of partner notification. Testing should in addition include NG culture, to evaluate NG antibiotic resistance. Since many SACs offer immediate prophylactic antibiotics against CT/NG, important information may be lost if no tests are performed before initiating treatment.

Some authors claim that STI testing should be omitted during the initial SAC visit, for fear of interfering with the legally important trace evidence collection (66). Norwegian SAC guidelines underline the importance of swabbing for trace evidence *before* the collection of microbial swabs, thus eliminating such interference and the need for two separate gynecological examinations. This is in accordance with the Norwegian model of being a clinician and a forensic examiner in the same pair of shoes. On the other hand, most forensic kits do not contain tests for STIs or BBVs, since these kits are equipped for legal purposes rather than for health care issues. A separate STI-test kit should be available to any forensic examiner dealing with victims of sexual assault. Since both clinical and legal aspects usually come together, it is advisable that all specimens collected from the victim for health care reasons should be retained in case of additional or repeated testing being required (206). Finally, the same principle of securing the chain-of-evidence should be applied to STI-testing as to the trace evidence collection and storage (205).

6.3.2 Toxicological findings and DFSA (Paper II)

Before our study, only self-reported data on alcohol and drug intake from police and SAC records were available in Norway, and little was known about the drugs used in DFSA cases.

We found that a quarter of the women suspecting proactive DFSA tested positive for a drug other than ethanol, although no cases of proactive DFSA could be unequivocally verified. However, the evaluation of the findings needs to be interpreted with caution, since patients with a history of drug abuse and/or anxiety disorder could

theoretically have been surreptitiously drugged by their usual medication. An urgent police-investigation in these cases could possibly have better results than those revealed by health care settings alone.

Finding so meager evidence of proactive DFSA in a Norwegian SAC could partly be explained by patients' late attendance, since only half of the patients were tested within a time frame of 12 hours after the assault. One message to the public is therefore to have samples for the toxicological test collected as soon as possible after a suspected DFSA. On the other hand, since as many as 128 patients actually had a drug test within 12 hours of the assault, we may in the future reassure concerned patients that such involuntary drugging probably happens only seldom in Norway.

Of more concern is the very high ethanol levels that could be estimated at the time of assault, and indicates a high degree of inebriation in unaccustomed young women. A mean BAC at time of the assault of almost 2 g/L renders most young women unable to give valid consent to sex. As described in section 2.1.2, this will qualify for being a victim of the legal definition of rape, and in my opinion, the BAC findings from blood tests should be used more as legal evidence of opportunistic DFSA.

Any causal relationship of high ethanol intake, high BAC levels, and rape could not, however, be established from our data. However, a report from the Norwegian Centre for Violence and Traumatic Stress Studies (NKVTS) points out that being under the influence of alcohol/drugs is one of the main risk factors for rape, after female gender and young age (16). In addition, U.S. cross-sectional publications point out that young women's heavy drinking increases vulnerability for sexual assault (207, 208), and that risk of sexual victimization increases with the level of estimated BAC (209). In addition, a recent school survey of almost 4,000 Norwegian teenage girls found that 70% of the girls had been intoxicated during the past year, of which 7% had experienced (incapacitated) sexual assault (210). The author found that both high frequency of intoxication and experiencing severe drunkenness were associated with being a victim of sexual assault among these young women. This knowledge should be used in preventive and informational campaigns targeting adolescents and young adults at schools or universities. However, I need to add that the victims are in no

sense responsible for the rape; the responsibility remains solely with the assailant. The distinction between vulnerability and possible risk factors on the one side and a responsibility and blame on the other side is essential, and must be unquestionable.

The National Bureau of Crime Investigation[117] collects annual information on reported rape cases (30). According to their report, a high proportion of the victims were influenced by alcohol and drugs during the rape. In November 2013, the Bureau initiated a preventive "gentleman" campaign.[118] This campaign is directed towards young men and calls on them to take care of their peers (especially females) rendered vulnerable because of the influence of alcohol/drugs. The main aim is to prevent sexual assaults occurring in a party context.

Only a few of the cases of suspecting proactive DFSA were police-reported, and none of them were taken to court. Awareness among the police and legal authorities is important, although evidence of both surreptitious drugging and rape seems to be hard to find. Except for a few cases of video-recorded documentation of sexual activity involving unconscious or non-responsive victims, prosecutors will have a hard time proving such crimes. This is in contrast to the clear Norwegian legal rules (section 2.1.2). Documentation of legal consequences in cases of proactive DFSA are rather scarce in non-English-speaking European countries, while in the U.K., U.S., Canada, and New Zealand, several cases has been prosecuted (211).

6.3.3 Injuries and trace evidence (Paper III and the EA)

We studied only those police-reported cases of rape where the victim had undergone a medical examination. Various aspects of medical evidence had different impact on charge filing of the case. Anogenital injury had no association with charge filing. However, more victims had documented moderate and/or severe extragenital injury among the charged cases vs. those cases dismissed because of insufficient evidence. This underlines the importance of proper injury documentation in the acute phase after rape.

We found that the analysis of trace evidence was associated with charge filing.

[117] Kripos
[118] Kjernekar

Trace evidence is used to assess physical contact between the victim and the assailant (or the venue). When the scenario is such that sexual activity seems plausible (that is, in cases of partner/acquaintance relationship), and situations where the assailant admits to sexual contact with the woman, the decision not to request analysis of biological samples may be reasonable. In such cases, the results might not supply the police or court with additional evidence. Given that the police may apply such logic, we would expect that trace evidence would be more often analyzed in the case of stranger/casual acquaintance relationship. This was not the case in our study. Still, reporting penetrative assault and attending medical examination within 24 hours of the assault had a borderline significant association with trace evidence analysis.

The presence of sperm did not influence the legal prosecution of the rape cases in our study, and others have stated that this has poor sensitivity in securing a conviction (146). Sperm findings alone do not give information about the host. If there is doubt whether sexual contact has taken place, a DNA analysis is necessary.

However, matching DNA between the victim and the suspect predicted a charge in four of the five cases in Paper III. This points out the importance of DNA-analysis in selected cases. However, even if DNA could be used as evidence of (sexual) contact between the suspect and the victim, no definitive answer as to consent or guilt may be given. DNA is of no value if the basis of the defense is consent. Nonetheless, we believe that DNA analysis is affordable in Western countries, and most reported rape cases are not intimate partner rapes. Therefore, DNA has at least the potential to contribute and in my opinion should be analyzed more frequently.

However, the finding of sperm and mismatching DNA to a suspect's could be used by the defense as an argument that no intercourse has taken place. In cases of such mismatch, this could be due to recent consensual intercourse unconnected to the rape. Nevertheless, an important role for the forensic doctor, therefore, is to inform the police and/or court that in some cases of sexual assaults, trace evidence is absent, for example, in cases of condom use, no ejaculation, azoospermic ejaculate, or if a foreign object was used to penetrate. As a consequence, absence of the suspects' DNA on the victim's body does not exclude him as a suspect.

Since the presented use of collected samples in Paper III dates more than ten years back, we expect that the police have increased their use of such evidence. In 2008, a legal reform made possible an expansion of the DNA registry for criminal investigation and procedure (212, 213). This will allow for more extensive testing and long-time registration of profiles. In addition, a recent national centralized funding model should secure that analysis of the collected trace evidence should be performed as appropriate in serious crime cases. However, this has yet to be evaluated.

Investigation of rape cases is often complicated. Since medico-legal evidence has limited impact on legal outcome, non-medical factors might even be more important, for example, the initial victim's statement, suspect's statement, other witnesses' statements, inspection of the venue, photographic documentation, torn or soiled garments, etc. Medical information alone does not secure charge filing, but may be a part of the evidentiary chain of factors strengthening the case. However, our criminal justice system only pleads cases when there is no reasonable doubt. Hence, a dismissal of the case due to insufficient evidence is not equal to ignorance or distrust in the victim, only that the evidence is not strong enough for a conviction. This is important to communicate to the victims in dismissed cases of rape.

6.4 Future research

Through the work of this thesis, many aspects of the area of sexual assault, involving medical examination and health consequences, remain unknown. Some suggestions for future research will be addressed in this section.

Since the main outcome of sexual assault medical examinations are the health and well-being of the victim, a qualitative research project should be initiated which would deal with the patients' experience of the SAC visit, especially regarding the anogenital examination. The emotional impact of the anogenital examination was evaluated in an earlier research project of non-abused preschool children conducted by members of our SAC team (214). In addition, as a part of the evaluation of Norwegian SACs, a questionnaire was handed out to adult and adolescent victims at the follow-up visit, but recruiting patients post-assault was a challenge (215). Even if

several aspects of the SAC consultation, like care-taking, psychosocial support, and follow-up were evaluated for some few patients, future studies should target especially the victims' experience of the physical examination. Through this, SAC staff could get useful information about how to adjust their service to take better care of the victims.

Since many SACs offer follow-up visits, especially regarding psychosocial care, a future study should evaluate the possibility of achieving active informed consent from the patients to participate in SAC record studies. Even if staff-demanding and follow-up could be subjected to considerable rates of dropping-out of participation in the studies, evaluation of certain health outcomes, like pregnancy, STI/BBV, and mental health consequences should be performed after certain intervals of the assault. Such a study is presently ongoing at the Stockholm SAC, and interesting preliminary results have been presented at a conference (216). In such a prospectively designed study, the effects of early interventions of psychosocial care could be evaluated. In addition, predictors for persistent high degree of PTSD[119]-symptoms could be established, which in turn could able us to select patients who are in the need of more targeted specialist health care.

Whether anogenital injuries are more common after rape than after consensual coital activity still remains uncertain. A recent Danish study of student volunteers have shown that injuries are rather common and long-standing after consensual sex (154). Certainly, more such studies are needed, and in a context of gynecological or general practice, since those performing sexual assault examinations in Norway are not forensic specialists. Preferable, however, would be to initiate a Nordic multi-center study of injuries after consensual sex, and including into this study an evaluation of the use of colposcopy in adult and adolescent anogenital examination.

There is a need for systematic registration of patients who have attended Norwegian SACs. I would suggest that a future health registry of all sexual assault victims attending Norwegian SACs be established. Essential baseline data of the patients, of the assault, and of the medical findings should be collected. SAC registry

[119] Post-traumatic Stress Disorder

data could then be linked to other health registries, for example, the Medical Birth Registry, the Cause of Death Registry, the Norwegian Prescription Database, or the Norwegian Labor and Welfare Service's registries. Through this, we could get knowledge about the impact of sexual assault on future health consequences. An example of such linkage has been performed in Iceland, where SAC visit information was linked to the national Icelandic birth registry (217217), and similar studies are ongoing in the Copenhagen SAC in Denmark. The establishment of such a registry has been tried elsewhere in Norway[120], but refused by the regional and national ethical committees. Ethical issues, therefore, could limit our possibilities to further study health consequences of sexual assault in a prospective design. The inclusion of research participation in Norway could be regarded as guided by the ethical committees' issues rather than scientists'.

Our quantitative study lacks essential case information of the flow of medical information in the individual police investigation of the cases. A qualitative research project interviewing the individual police investigators and prosecutors, and describing their way of thinking about the use of medical information, could rule out when medical information actually was invaluable for a case to be proceeded. Such research could detect examples of how trivial medical findings was crucial for rape cases to be proceeded in court, since regular feed-backing from police to health care and wise versa is often hampered by the professional secrecy.

Another study could scrutinize in-depth all of the individual Norwegian SAC forensic medical reports, evaluating whether the reports are correctly written, whether the interpretations stand to reason, or if the conclusions relate medical findings to the history in a proper way. Educating and giving feedback to Norwegian physicians regarding writing forensic reports must be a prioritized issue for securing future quality of medical information in police-investigated rape cases.

Finally, it is essential to secure that validated direct and behaviorally specific questions about experienced victimization (and perpetration) of sexual assault are included in future population-based health surveys. Questions regarding whether the

[120] By the National Centre for Emergency Primary Health Care

subject was injured during the assault and whether the event was reported to health care and/or police should be added. Both genders are to be asked and the information gained combined with other health outcome measures. An example of a longitudinal study which should implement such questions in their self-reporting surveys is the future HUNT[121]-4 study.

7 Conclusion

This thesis demonstrates that STI prevalence among more than 400 SAC attenders was lower than in the comparable clinical population, and that only two cases were probably assault-transmitted. Furthermore, alcohol was the dominant drug found in urine/blood samples from SAC patients, and no cases of DFSA could be unequivocally verified. Finally, more than half of the police-reported rape cases were dismissed because of insufficient evidence, and only a tenth of the cases were taken to court. In such cases, a higher proportion had moderate/serious body injury and more DNA analyses were performed. However, medical findings altogether seemed to have little impact on charge filing.

Quick and available access to qualified health care after sexual assault should ensure valuable help for victims and protect their legal rights. However, both health care and the police would benefit from better cooperation and exchange of knowledge in order to ultimately improve the outcomes for victims of sexual assault.

[121] The Nord-Trøndelag Health Study

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