Signals in the hospital Emergency Room linking objective signs to child abuse knowledge
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Chapter 1
General introduction
## Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAP</td>
<td>American Academy of Pediatrics</td>
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<tr>
<td>ACE</td>
<td>Adverse Childhood Experiences</td>
</tr>
<tr>
<td>AHT</td>
<td>Abusive Head Trauma</td>
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<tr>
<td>AMK</td>
<td>in Dutch: Advies- en Meldpunt Kindermishandeling; Child Abuse Counselling and Reporting Centre, since 2016 called Veilig Thuis (VT)</td>
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<tr>
<td>CAN</td>
<td>Child abuse and neglect</td>
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<tr>
<td>CSA</td>
<td>Childhood sexual abuse</td>
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<tr>
<td>CPS</td>
<td>Child Protection Services</td>
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<tr>
<td>EA</td>
<td>Emotional abuse</td>
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<tr>
<td>ED</td>
<td>Emergency Department</td>
</tr>
<tr>
<td>EN</td>
<td>Emotional neglect</td>
</tr>
<tr>
<td>FII</td>
<td>Fabricated or induced illness in children</td>
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<tr>
<td>IPV</td>
<td>Intimate partner violence</td>
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<tr>
<td>NatSCEV</td>
<td>National Survey of Children’s Exposure to Violence</td>
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<tr>
<td>NEDS</td>
<td>Nationwide Emergency Department Sample</td>
</tr>
<tr>
<td>NHAMC</td>
<td>National Hospital Ambulatory Medical Care Survey</td>
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<tr>
<td>PA</td>
<td>Physical abuse</td>
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<tr>
<td>PCF</td>
<td>Pediatric Condition Falsification</td>
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<tr>
<td>PN</td>
<td>Physical neglect</td>
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<tr>
<td>PTSD</td>
<td>Post-Traumatic Stress Disorder</td>
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<tr>
<td>TTI</td>
<td>‘top–toe’ inspection</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>VT</td>
<td>in Dutch Veilig Thuis, Child Abuse Counseling and Reporting Centre, called AMK (Advies- en Meldpunt Kindermishandeling) before 2016</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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</table>
General Introduction

Child abuse and neglect (CAN), also referred to as child maltreatment, is defined by the World Health Organization (WHO) as all forms of physical and emotional ill-treatment, sexual abuse, neglect, and exploitation that result in actual or potential harm to the child’s health, development or dignity in the context of a relationship of responsibility, trust or power. In western societies exposure to intimate partner violence (IPV) is also increasingly recognized as a form of child maltreatment. In the Netherlands, in the Youth Act, CAN is defined as ‘Every form of threatening or violent behavior towards minors of physical, psychological or sexual nature. This behavior is forced on minors actively or passively by parents or other persons towards whom minors feel dependent and lack freedom, and (threatens to) cause serious harm in the form of physical or psychological damage.’

Different subtypes of CAN can be distinguished. The World report on violence and health and the 1999 WHO Consultation on Child Abuse Prevention distinguish four types of child maltreatment: physical abuse (PA); child sexual abuse (CSA); emotional and psychological abuse (EA); and neglect. Different and more extensive divisions into subtypes are used in literature (for instance in physical abuse, physical neglect (PN), emotional neglect (EA), emotional (or psychological) abuse, exposure to intimate partner violence (IPV) of parents, pediatric condition falsification (PCF, also called fabricated or induced illness in children (FII), or medical child abuse), exploitation, prenatal abuse and child sexual abuse. It is important to note that definitions of subtypes can differ, as for instance for sexual abuse in medical literature and also between medical literature and legal publications. Overlap between definitions of subtypes is also possible.

Child sexual abuse
The WHO defines sexual abuse as the involvement of a child in sexual activity that he or she does not fully comprehend, is unable to give informed consent to, or for which the child is not developmentally prepared and cannot give consent, or that violates the laws or social taboos of society. Child sexual abuse is evidenced by this activity between a child and an adult or another child who by age or development is in a relationship of responsibility, trust or power, the activity being intended to gratify or satisfy the needs of the other person. This may include but is not limited to:

- the inducement or coercion of a child to engage in any unlawful sexual activity;
- the exploitative use of a child in prostitution or other unlawful sexual practices;
- the exploitative use of children in pornographic performance and materials.

Dutch criminal law has several articles concerning sexual abuse, including assault, rape, fornication, child pornography, child prostitution, seduction and grooming. In fact, according to Dutch criminal law, all sexual acts with a person below the age of 16 are punishable. In practice, voluntary sexual contact between juveniles is not persecuted by the police but is seen as normal sexual experimentation.
Chapter 1

Physical abuse
The WHO defines PA as the intentional use of physical force against a child that results in – or has a high likelihood of resulting in – harm for the child’s health, survival, development or dignity. This includes hitting, beating, kicking, shaking, biting, strangling, scalding, burning, poisoning and suffocating.7 Much physical violence against children in the home is inflicted with the object of punishing. The American Association of Pediatrics (AAP) states that the recognition and reporting of physical abuse is influenced by variations in both legal and personal definitions of abuse and despite calls from the AAP for the abolishment of corporal punishment in schools by all states, states still differ in their acceptance of corporal punishment.8 In the Netherlands, since April 2007, as in 43 other countries following international adoption of the Convention of the Rights of the Child, hitting a child is a criminal offence.9

Physical Neglect
Neglect (both physical and emotional) is the most frequent documented type of CAN by child abuse agencies.3 PN occurs when the parent or caregiver does not provide the child with basic necessities like adequate food, clothing and shelter, the lack of which has caused or would cause serious injury or illness. Failure or refusal to provide these necessities endangers the child’s physical health, well-being, psychological growth and development. PN also includes child abandonment, inadequate supervision, rejection of a child leading to expulsion from the home and failure to adequately provide for the child’s safety and physical and emotional needs.

Emotional neglect
In the WHO definition, EN is included within the category of neglect with a separate category of emotional abuse, whereas the two aspects are encompassed in the broader term psychological maltreatment.10 Neglect has been defined by the Consultation on Child Abuse Prevention as the failure to provide for the development of the child in all spheres: health, education, emotional development, nutrition, shelter, and safe living conditions, in the context of resources reasonably available to the family or caretakers and causes or has a high probability of causing harm to the child’s health for physical, mental, spiritual, moral or social development.3 This includes the failure to properly supervise and protect children from harm as much as is feasible. Emotional neglect refers to the failure to meet children's emotional needs, and includes for example the failure to provide adequate nurturance and affection, allowing children to be witnesses of domestic violence, to knowingly permit maladaptive behavior by the child, the failure to seek care for emotional of behavioral problems, and the failure to provide adequate structure.11 Educational neglect refers to the failure to provide the care and supervision that are necessary to secure a child’s education.11 It includes for example failing to enroll a child of mandatory school age in school, permitting chronic absence from school, and failing to attend to special educational needs. Educational neglect is sometimes seen as a subcategory of emotional neglect.
Emotional abuse
There is no universally agreed definition of emotional or psychological abuse, terms that are often used interchangeably.\textsuperscript{12} EA encompasses both the cognitive and affective components of maltreatment.\textsuperscript{2} One of the difficulties in clearly defining what such maltreatment comprises involves the absence of a strong societal consensus on the distinction between psychological maltreatment and suboptimal parenting.\textsuperscript{3} Exposure to psychological maltreatment is considered when acts of omission or commission inflict harm on the child’s well-being, which may then be manifested as emotional distress or maladaptive behavior in the child.

Prevalence of CAN in high-income countries
Child maltreatment has a high prevalence and is a major problem in all parts of the world. Current estimates vary depending on the country, the definition of CAN used in the study, the type of CAN studied, the coverage and quality of official statistics and the coverage and quality of surveys that request self-reports from victims, parents or caregivers.\textsuperscript{3,3} Usually a ten-fold gap is found between studies based on self-report and child protection agency figures, reflecting the fact that a large group of maltreated children does not receive appropriate care.\textsuperscript{3} In 2009 Gilbert et al. published an overview of prevalence of studies and reports on CAN in high-income countries.\textsuperscript{3} Based on data from agencies 1.5-5.0\% of children are referred to Child Protection Services (CPS); and 0.7-2.8\% of children have CAN substantiated. Based on self-report and parent report the yearly prevalence of PA abuse alone varies between 3.7-29.7\%, and the cumulative prevalence of PA between 3.7 and 33.3\%. More recent studies on the prevalence of CAN published after 2010 are presented in Table 1 (based on data from professional informants and agency reports) and Table 2 (based on self-reports). Self-reports show higher figures compared to studies based on professional informants or data from agencies. One exception is the rather high figure found for CSA in Switzerland.\textsuperscript{31}

Prevalence of CAN in the Netherlands
Prior to 2005 the prevalence of CAN in the Netherlands was never systematically assessed and based on studies from the USA a yearly rate of 50,000-80,000 new victims was assumed. In 2005 two prevalence studies were performed: one based on agency reports (Child Abuse Counselling and Reporting Centre, in Dutch Veilig Thuis (VT), before 2016 called Advies- en Meldpunt Kindermishandeling (AMK/VT)) and sentinel reports (more than 1,000 professionals), the NPM study, and one based on self-reports from 1,845 high school students.\textsuperscript{26,27} Society and politics were shocked by the results of these two studies. The NPM-2005 estimated an annual case rate of 107,200 children and a yearly prevalence of 3\%. The Pupils on Abuse Study-2005 estimated a cumulative prevalence of more than 30\% and a yearly prevalence of 19.5\%. In the second National Prevalence study on Maltreatment (NPM-2010) the same three methods were used.\textsuperscript{26,27} First, 1,127 professionals (sentinels) reported each child for whom they suspected CAN during a
### Table 1. International prevalence studies published after 2010 based on data from professional informants or agency reports

<table>
<thead>
<tr>
<th>First author and publication date</th>
<th>Country</th>
<th>Study type</th>
<th>CAN type</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoltenborgh et al14; 2011</td>
<td>Worldwide</td>
<td>Meta-analysis</td>
<td>CSA</td>
<td>Yearly 0.4%</td>
</tr>
<tr>
<td>Maier et al13; 2013</td>
<td>Switzerland</td>
<td>Retrospective</td>
<td>CSA</td>
<td>Yearly 2.68% (1.11% in males, 4.33% in females).</td>
</tr>
<tr>
<td>Stoltenborgh et al15; 2013</td>
<td>Worldwide</td>
<td>Meta-analysis</td>
<td>PA</td>
<td>Yearly 0.3%</td>
</tr>
<tr>
<td>Wildeman et al16; 2014</td>
<td>USA</td>
<td>Retrospective</td>
<td>All types</td>
<td>Cumulative 12.5%</td>
</tr>
</tbody>
</table>

### Table 2. International prevalence studies published after 2010 based on self-reports

<table>
<thead>
<tr>
<th>First author and publication date</th>
<th>Country</th>
<th>CAN type</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stoltenborgh et al14; 2011 (meta-analysis)</td>
<td>Worldwide</td>
<td>CSA</td>
<td>Yearly 12.7%</td>
</tr>
<tr>
<td>Radfort17; 2013</td>
<td>UK</td>
<td>CSA in girls</td>
<td>Cumulative 18.6%</td>
</tr>
<tr>
<td>Finkelhor18; 2014</td>
<td>USA</td>
<td>CSA by caregivers</td>
<td>Cumulative 0.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSA by caregivers and non-caregivers</td>
<td>Cumulative 2.2%</td>
</tr>
<tr>
<td>Finkelhor18; 2014</td>
<td>USA</td>
<td>CSA</td>
<td>Cumulative 26.6% for girls and 5.1% for boys</td>
</tr>
<tr>
<td>Christoffersen20; 2013</td>
<td>Denmark</td>
<td>CSA</td>
<td>Cumulative 3.4%</td>
</tr>
<tr>
<td>Iffland21; 2013</td>
<td>Germany</td>
<td>CSA</td>
<td>Cumulative 6.2%</td>
</tr>
<tr>
<td>Mohler-Kuo22; 2014</td>
<td>Switzerland</td>
<td>CSA (girls vs boys)</td>
<td>Cumulative 35.1% vs. 14.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSA without penetration</td>
<td>Cumulative 14.9% vs. 4.8%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CSA with penetration</td>
<td>Cumulative 2.5% vs. 0.6%</td>
</tr>
<tr>
<td>Stoltenborgh et al15; 2013 (meta-analysis)</td>
<td>Worldwide</td>
<td>PA</td>
<td>Yearly 22.6%</td>
</tr>
<tr>
<td>Finkelhor18; 2014</td>
<td>USA</td>
<td>PA</td>
<td>Cumulative: 4.0%</td>
</tr>
<tr>
<td>Christoffersen20; 2013</td>
<td>Denmark</td>
<td>PA</td>
<td>Cumulative: 5.4%</td>
</tr>
<tr>
<td>Iffland21; 2013</td>
<td>Germany</td>
<td>PA</td>
<td>Cumulative: 12.0%</td>
</tr>
<tr>
<td>Finkelhor18; 2014</td>
<td>USA</td>
<td>EA</td>
<td>Cumulative: 5.6%</td>
</tr>
<tr>
<td>Finkelhor18; 2014</td>
<td>USA</td>
<td>Neglect</td>
<td>Cumulative: 4.7%</td>
</tr>
<tr>
<td>Christoffersen20; 2013</td>
<td>Denmark</td>
<td>PN</td>
<td>Cumulative: 3.0%</td>
</tr>
<tr>
<td>Iffland21; 2013</td>
<td>Germany</td>
<td>PN</td>
<td>Cumulative: 48.4%</td>
</tr>
<tr>
<td>Iffland21; 2013</td>
<td>Germany</td>
<td>EN</td>
<td>Cumulative: 13.9%</td>
</tr>
<tr>
<td>Christoffersen20; 2013</td>
<td>Denmark</td>
<td>EA</td>
<td>Cumulative: 5.2%</td>
</tr>
<tr>
<td>Iffland21; 2013</td>
<td>Germany</td>
<td>EA</td>
<td>Cumulative: 10.2%</td>
</tr>
<tr>
<td>Finkelhor23; 2013</td>
<td>USA</td>
<td>Witnessing IPV</td>
<td>Cumulative: 17.3%</td>
</tr>
<tr>
<td>Radford24; 2013</td>
<td>UK</td>
<td>All types</td>
<td>Cumulative: 24.5%</td>
</tr>
</tbody>
</table>
period of three months. Second, 22,661 substantiated cases reported in 2010 to the Dutch Counselling and Reporting Centre (AMK/VT) were included and third 1,920 high school students filled out a questionnaire. The overall prevalence of CAN in the Netherlands in 2010 was 3.38% based on the first two sources of information. Based on the self-reports (using the same strict definition) the yearly prevalence was 9.94%.

In 2014, the National Rapporteur on Trafficking in Human Beings and Sexual Violence against Children, Mrs. C.E. Dettmeijer-Vermeulen published figures on the prevalence of sexual violence. She estimated a yearly prevalence of child sexual abuse in 62,000 new children. The cumulative prevalence of any form of sexual violence is 32%, 41% in girls and 23% in boys. One in 10 girls experiences involuntary manual sex and 1 in 20 involuntary oral or genital sex.

In conclusion, CAN is a widespread, global phenomenon affecting the lives of millions of children all over the world.9

**Victims of CAN presenting in health care**

O’Donnell showed that children with CAN allegations and substantiations had higher mean prior hospital admission rates compared to controls.30 Higher rates of general admissions and admissions for injuries, infections, mental and behavioral disorders, and external causes of morbidity, were associated with a markedly increased risk of CAN allegations and substantiation. This shows that the hospital can play an important role in the identification of CAN, referral and prevention of re-abuse. Trends in hospital admissions in England and Scotland for CAN or violence related injuries between 2005 and 2011 were analyzed by Gonzalez-Izquierdo et al.31 They found a maltreatment or violence injury incidence rate of 86.9 per 100,000 in children < 1 year, 18.8 per 100,000 in children 1-10 years and 118.4 per 100,000 in children 11-18 years old. In all admissions for injuries 6.2% (England) and 7.0% (Scotland) were related to maltreatment or violence. In a 10 years’ time period (1999-2010) the average annual rates of hospital admission in a Northern region of Australia of children with a definitive code of CAN were 8.8 for Aboriginal and 0.9 for non-Aboriginal children, per 10,000 children.32 PA was the prominent type of maltreatment-related admission.

Farst et al. used a large inpatient database, the Healthcare and Utilization Project Nationwide Inpatient Sample, to determine trends in hospitalization in the US for severe abusive injuries from 1997 to 2009.33 The rate of hospitalization for all children 0–3 years for severe abusive injury was 23.6 per 100,000, and the rate did not significantly change over the last 14 years. Abused infants had higher injury severity scores and higher rates of admission of 60.3 per 100,000 compared to non-abused children aged 1-3.
Florence at all tried estimate health care costs associated with CAN. They estimated that children who were identified as maltreated or as being at risk for maltreatment by Child Protection Services (CPS) agencies incurred, on average, Medicaid expenditures that were $2600 higher per year compared with children not so identified. This finding accounted for +/− 9% of all Medicaid expenditures for children.

**Risk and protective factors for CAN**

Although CAN is not confined to a certain culture or social class, in the presence of so-called risk factors, the risk for CAN increases. The major risk factors reported in the second Dutch prevalence study on CAN (NPM-2010) are parental low education, immigrant status, unemployment and single parenthood. In the data collected via professionals and the AMK/VT, after correction for educational level of the parents and for step-parenthood, the risk factor immigrant status disappeared for the traditional immigrant families from Turkey, Morocco, Surinam and the Antilleans. Non-traditional families, a more recent group of immigrants who often are refugees, remained at increased risk for CAN after correction for family and socioeconomic factors. A possible mediating factor between risk factors and CAN is parental stress, associated with low socioeconomic situation, step-parenthood and a refugee status.

Numerous child factors are associated with CAN, e.g. CAN is about three times as frequent in children with disabilities as in their non-disabled peers. Girls have a higher risk of being sexually abused compared to boys, although rates of other types of maltreatment are similar for both sexes in high-income countries. In low-income countries, girls are at higher risk for infanticide, CSA, and neglect, whereas boys seem to be at greater risk for PA through corporal punishment.

The WHO Fact sheet on CAN categorizes risk factors in four domains (Table 3). The Centers for Disease Control and Prevention added additional risk factors: young parental age, large number of dependent children, non-biological children, transient caregivers in the home (e.g., mother’s male partner) and parental perception that maltreatment behavior is justified.

In contrast to the above-mentioned factors there also is scientific evidence that a supportive family environment and social network act as a protective factor for CAN. The following factors are potential protective: nurturing parenting skills; stable family relationships; household rules and child monitoring; parental employment; adequate housing; access to health care and social services; caring adults outside the family who can serve as role models or mentors; communities that support parents and take responsibility for preventing abuse.
Under detection of CAN and risk factors for re-referral/ re-abuse

Children who have been maltreated are at increased risk of further maltreatment due to PA. Identification of (relatively mild) injuries or other signs of CAN is the cornerstone of early detection of a child at risk for further abuse.\(^3\) Physical abuse is often an underreported problem due to a variety of reasons including misdiagnosis. One study revealed that 31\% of infants and children with AHT were initially misdiagnosed.\(^4\) A study by Sieswerda et al. showed evidence for prior abuse in 81\% of abusive head trauma cases.\(^5\) A study using data from Child Protection Services (CPS) in Rhode Island shows a re-referral rate of approximately 40\% in 3.75 years.\(^6\) The first 6 months after the first recognized incident is the period of greatest risk. Family poverty seems to be the strongest predictor of re-referral to CPS. The effect of age was significant. Compared to infants (ages 0-1), there was a significant decrease in the likelihood of recurrence for children ages 6-10, ages 11-15, and children ages 16-17. A history of prior substantiated maltreatment (i.e., preceding the index event) increased the likelihood of a repeated allegation to CPS. No differences in recurrence of allegations were found for boys compared to girls. Children with an

### Table 3. Risk factors for CAN from the WHO fact sheet on CAN

<table>
<thead>
<tr>
<th>Domain</th>
<th>Risk factors</th>
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| **Child**                       | Being < 4 years old or an adolescent  
                                 | Being unwanted, or failing to fulfil the expectations of parents  
                                 | Having special needs (e.g., disabilities, mental retardation, mental health issues, and chronic physical illnesses), crying persistently or having abnormal physical features  |
| **Parent or caregiver**         | Difficulty bonding with a new-born  
                                 | Not nurturing the child  
                                 | Having been maltreated themselves as a child  
                                 | Lacking awareness of child development or having unrealistic expectations  
                                 | Misusing alcohol or drugs, including during pregnancy  
                                 | Being involved in criminal activity  
                                 | Experiencing financial difficulties  |
| **Relationship**                | Physical, developmental or mental health problems of a family member  
                                 | Family breakdown or violence between other family members  
                                 | Being isolated in the community or lacking a support network  
                                 | A breakdown of support in child rearing from the extended family  |
| **Community and societal factors** | Gender and social inequality  
                                 | Lack of adequate housing or services to support families and institutions  
                                 | High levels of unemployment or poverty  
                                 | The easy availability of alcohol and drugs  
                                 | Inadequate policies and programs to prevent child maltreatment, child pornography, child prostitution and child labor  
                                 | Social and cultural norms that promote or glorify violence towards others, support the use of corporal punishment, demand rigid gender roles, or diminish the status of the child in parent–child relationships  
                                 | Social, economic, health and education policies that lead to poor living standards, or to socioeconomic inequality or instability  |
identified disability were significantly more likely to be re-referred than those without a disability. A family history of child welfare involvement for alcohol or drug use increased the likelihood of re-referrals. Household history of domestic violence was not related to the likelihood of repeated allegations to CPS.

A study examining predictors of re-referral among 149 urban children originally referred for maltreatment as infants shows a re-referral rate of 42.3% over a period of 11 to 15 years. Specifically, children who were physically or sexually abused were 4.55 times more likely to be re-referred than children who did not experience physical or sexual abuse. Substantiated cases were twice as likely to be re-referred as non-substantiated cases.43 A systematic review on this topic showed that the most important predictors of recurrent maltreatment are: number of previous episodes of maltreatment, neglect (as opposed to other forms of CAN); parental conflict and parental mental health problems.44

Sheets et al. reviewed 401 infants under the age of 12 months, 200 of whom were definitively abused as diagnosed by their child protection team, 100 with intermediate concerns for abuse, and 101 control infants seen by the child protection team with low level of concern for abuse.45 Injuries due to PA were identified in 27.5% of the definitively abused infants, 8% of the intermediate concern, and none of the non-abused infants. Bruising in a pre-mobile infant, intraoral injury, such as frenulum tears or tongue bruising, and fractures were the identified injuries. The authors found that children with these injuries were 4.4 times more likely to have future abusive injuries. Carty and Pearce estimated that 12% of children visiting the ED with injuries due to physical abuse knowingly or unknowingly were sending home and returned with further injury, 12% of them died and 20% developed a handicap.46

Early identification of abusive injuries is imperative because of the risk of increased mortality with each recurrent abusive event. Deans et al. describe a mortality rate of 24.5% with recurrent non-accidental trauma compared with 9.9% mortality in a single event of non-accidental trauma.47 In a longitudinal study of 914 children with at least 1 episode of PA Medicaid insured, 39% had at least 1 event of re abuse, 12% had 2 events and 5% had ≥ 3 events; factors associated with an increased risk for a recurrent episode of suspected NAT with higher severity score were living in a rural area and having an open wound or superficial injury. In contrast, a greater number of injuries was associated with a decreased risk for a recurrent event of PA with a higher severity score.48 Perhaps children with “minor” injuries or less numerous injuries are less often reported to CPS and less often removed from the unsafe environment.

CAN can be identified in at least 9.4% of the contact children in the household of the abused patient.49 Protocol-indicated skeletal surveys identified at least 1 abusive fracture in 16 of 134 contacts (11.9%) <24 months of age, indicating that early recognition is not only beneficial for the index child but also for the other children in the household.50
Consequences of CAN
The consequences of CAN can be profound and may endure long after the CAN occurred. The effect can appear in childhood, or adulthood, and may affect various aspects of an individual’s development (e.g. physical, cognitive, psychological, and behavioral). These effects range in consequence from minor physical injuries, low self-esteem, attention disorders, and poor relations to severe brain damage, extremely violent behavior and death.

Research in this field has limitations. Many research efforts have studied the effects of CAN in populations from a low socioeconomic background, prison populations, mental health patients, with parental substance abuse, domestic violence etc. Some studies did not use a control group in which no maltreatment occurred, and studies use official records of CAN and self-report which can both undercount the true prevalence of CAN.

Death
Death can be the outcome of CAN. It can, for example, result from injuries obtained by physical abuse, from injuries obtained by accidents as a result of neglect, by poisoning or smothering in cases of Pediatric Condition Falsification (PCF), by withholding nutrition or medical treatment in cases of neglect or by self-harm or suicide due to the psychiatric problems caused by the CAN. WHO estimated that 155,000 deaths in children younger than 15 years occur worldwide every year as a result of abuse or neglect, which is 0.6% of all deaths and 12.7% of deaths due to any injury. Based on data from CDC’s National Violent Death Reporting System (NVDRS) in 2010, the homicide rate in 16 US states for infants aged < 1 year was 6.7, for children 1-4 years 2.3, for children 5-9 years 0.5, for children 10-14 years 0.6 and for children 15-19 years 6.8 per 100.000 population. Palusci et al. studied cases from data in the U.S. National Child Death Review Case Reporting System between 2005-2009. Among 49,947 child deaths from 23 states entered into the Case Reporting System during the study period, there were 2,285 cases (4.6%) in which CAN caused or contributed to fatality. Over one-half had neglect identified as the type of CAN, and 30% had AHT. Seven of 37 homicide victims aged 2 to 37 months old infants died of homicide were seen in the health care system with signs and symptoms of CAN.

For the years 2008-2010, of the 16,897 ED visits in a US national representative sample that were attributed to child PA, 5,182 (30.7%) required hospitalization. Death occurred in 246 patients (1.5%), (13 in ED and 233 following hospitalization). Multivariable analyses revealed each 1 year increase in age was associated with lower odds of mortality.

The most cited study on fatal CAN in the Netherlands is the study of Kuyvenhoven et al., based on retrospective interviews amongst general practitioners and pediatricians in 1996. In this study with a response rate of 83% 33 cases of recognized fatal CAN were reported, extrapolated to a minimum of 40 recognized cases in 3502,454 (11/100,000) children per year, corresponding with 2.1% of all deceased minors.
A second study was performed in the Netherlands Forensic Institute (NFI), the study population consisted of 445 minors in whom a forensic autopsy was performed between 1996 and 2009.\textsuperscript{56} Of these cases, 54\% (n = 239/445) were non-natural and non-accidental due to CAN, 87 of the maltreated children (36\%) were between 8 days and 2 years old. This corresponded with an annual average of 15 (30\%) ‘proven’ and 2 (5\%) ‘highly probable’ cases of fatal CAN. The total number of abandoned babies, foundlings and otherwise, was on average 4 per year. A discrepancy with the study of Kuyvenhoven et al. was shown, on the one hand 13 of 23 (56\%) CAN fatalities were not represented in the Kuyvenhoven study, on the other hand 1 child in the Kuyvenhoven study was not accounted for in the NFI autopsy. One can therefore conclude that the actual number of cases of fatal CAN in the Netherlands is underreported.

**Short term consequences**

Physical short term consequences of CAN are diverse. Physical abuse can, e.g. lead to external bruises, burns, lacerations, fractures, and damage to internal organs or the brain. Neglect can lead to growth disturbances and developmental delay. Sexual abuse can infrequently lead to damage to the external genitals or anus, a sexual transmitted disease or pregnancy.

Infants and young children are particularly vulnerable to the physical effects of CAN. The health consequences of abusive head trauma (AHT) can range from vomiting or irritability to more severe effects such as concussions, respiratory distress, seizures and death. Possible consequences are partial loss of vision or blindness, learning disabilities, mental retardation, cerebral palsy or paralysis.\textsuperscript{57} About 15-23\% of these children die within hours or days after the incident. Studies among AHT survivors demonstrate that approximately one-third of the children are severely disabled, one-third of them are moderately disabled and one-third has no or only mild symptoms.

Infants who have been neglected and malnourished may experience a condition known as “nonorganic failure to thrive”. With this condition the child’s weight, height and motor development fall significantly below age-appropriate ranges and no organic cause is found. It can lead to continued growth retardation and cognitive and psychological problems.

CAN can cause different emotional and behavioral problems. Some children can become aggressive or antisocial; others withdraw, worry much or become anxious. The behavioral problems can lead to difficulties in dealing with peers, being bullied, bullying, and excluded.\textsuperscript{58} The following psychiatric symptoms can arise: flashbacks, nightmares and fears in the context of a Post-Traumatic Stress Disorder (PTSD); dissociative symptoms; auto mutilation; functional/ psychosomatic complaints (headache, belly ache, chronic fatigue).
Long term consequences

In the last decennia amongst others the ACE study (Adverse Childhood Experiences) showed that adults with traumatic experiences in childhood are more likely to have chronic physical conditions like diabetes mellitus, asthma, cancer and vascular diseases (ischemic heart disease) and suffer more frequent from psychosomatic complaints like belly ache and headache. In the ACE-study a cohort of 17,000 mostly white middle class Americans is studied showing an unexpected high prevalence of ACE categories (emotional abuse, physical abuse, sexual abuse, inter partner violence against the mother, addiction in the family, a family member in jail, a family member with psychiatric problems, not being raised by both biological parents, physical neglect and emotional neglect). Only 36% of the study group indicates never to be neglected or abused. The prevalence of psychiatric and somatic problems showed a direct relation with the amount of ACE categories experienced by the individual. Felitti et al. conclude that CAN is one of the most basal and long-term determinants of adult health. They show that an unhealthy life style is no choice but more a manner to handle traumatic experiences: obesity can protect from being sexual abused and alcohol, smoking and substance abuse can suppress memories from being abused. Some results of the ACE study are reproduced for the Netherlands. In 44% the subjects report CAN, in this group diabetes, asthma, substance abuse and depression are more prevalent.

In a cross-sectional survey of asthma, cancer and cardiac patients and healthy controls 40-60 years old from Saudi Arabia, frequent beating (once or more per month) and insults in childhood were associated with a significantly increased risk for cancer (RR = 1.7), cardiac disease (RR = 1.3) and asthma (RR = 1.6), with evidence of increased risk for cancer and asthma with beating frequency of once every 6 months or more.

Research published on long term consequences of CAN varies in used methodology. Cohort studies that prospectively ascertained whether children were maltreated or not, and which followed up these children over time to identify later outcomes have more strengths than cohort or cross-sectional studies using retrospective measurement of CAN, like the ACE study and the above mentioned study on beating and insulting during childhood. However, studies that use only official cases of child maltreatment might detect only the few maltreated children who come to professional attention, who might differ in some ways from other maltreated children and whose outcomes could also be different.

Below, in particular prospective studies and systematic reviews are discussed.

Long term consequences of sexual abuse

With respect to sexual abuse a systematic review and meta- analysis published in 2009 showed a significant association between a history of sexual abuse and lifetime diagnosis of functional gastrointestinal disorders (OR, 2.43), nonspecific chronic pain (OR, 2.20), psychogenic seizures (OR, 2.96) and chronic pelvic pain (OR, 2.73). There was no
statistically significant association between sexual abuse and a lifetime diagnosis of fibromyalgia, obesity and headache. When analysis was restricted to studies in which sexual abuse was defined as rape, significant associations were observed between rape and a lifetime diagnosis of fibromyalgia (OR, 3.35), chronic pelvic pain (OR, 3.27), and functional gastrointestinal disorders (OR, 4.01).

A meta-analytic review of Irish et al. using studies comparing individuals with or without a history of childhood sexual abuse (CSA) showed that a history of CSA was associated with small to moderate group differences on the following health outcomes assessed: general health, gastrointestinal health, gynecologic or reproductive health, pain, cardiopulmonary symptoms and obesity.65

**Screening for CAN at Emergency Departments (EDs)**

Woodman et al. estimated that about 1% of all injury-induced child visits to an ED are due to CAN.66 Pless estimated that 1.3% to 15% of injuries in children that result in ED visits are actually caused by PA.67 Using data from the National Hospital Ambulatory Medical Care Survey (NHAMCS) from 2000 through 2008, 1.2% of children visiting EDs in the USA were victims of CAN.68 Early detection rates of CAN at EDs differ between different countries and studies from 0.03% to 10%, likely due to different populations studied, different definitions used and different practice including the use of screening tests.67-75 Allareddy et al estimated that about a third of the patients visiting the ED with injuries due to physical abuse required hospitalization and 1.55% of these patients died.54 1.3% of them also were victim of sexual abuse.

Dutch studies show figures of suspected CAN in 0.2% of ED visits in a multicenter study performed by Louwers et al.76 In a later performed accuracy study of a screening instrument the same author found a prevalence of confirmed PA in 0.22% of 38,136 patients.77 Sittig found a 0.07% prevalence of confirmed PA in her study on the value of systematic screening at EDs 77. It is obvious that detection of CAN at ED is a challenge and needs to be improved: CAN is missed.39,40,42,46,48,53,78-83 In a Dutch retrospective chart study CAN was missed in 11 of 93 children visiting the ED.94 Missing CAN has severe consequences: children suffer subsequent abuse, children at the household are at risk and children are at increased risk for mortality at each subsequent evaluation.40,47,48,82

The importance of early identification and protective intervention on behalf of abused children cannot be overestimated. Many EDs have started to use screening instruments for CAN.66,72,78,85,86 Woodman et al concluded in their 9 systematic reviews on the clinical effectiveness of screening tests for PA in children attending EDs that there was no evidence that any test was highly predictive of PA. There was weak evidence that a community liaison nurse improved the performance of the screening assessment in ED, and it was estimated that combining a nurse with the standard screen would result in referral to
social services of about half of the abused children attending the ED. However, given the poor quality of the data, this is highly uncertain. The addition of screening protocols to the clinical screening assessment offered marginal benefits, and additional false-positive referrals exceeded additional abused children detected. The benefits of protocols declined as the accuracy of the clinical screening assessment improved. The most effective protocol was to refer all injured infants and children who were social work active. Louwers selected 15 papers in her systematic review on screening for CAN at EDs of which 4 were finally included. In these studies a checklist with indicators of risk for CAN was used. After implementation, the rate of detected cases of suspected child abuse increased by 180% (weighted mean in three studies). The number of confirmed cases of child abuse, reported in two out of four studies, showed no significant increase.

Much effort has been put in developing tools aimed at identifying neglect and physical and emotional or sexual abuse in children visiting EDs or other departments of hospitals, like clinical decision rules, mostly focused on typical case presentations like acute traumatic intracranial injury, fractures with bruising, or suspicion of sexual abuse. Examples are tests based on the findings in the anal and genital examination, lists of symptoms like several changes in behaviors, questionnaires for parents and children and decision rules combining clinical symptoms and results of Computer Tomographic images. Bailhache et al. conclude in their systematic review in 2013, there is low-quality evidence on the accuracy of these instruments for identifying CAN and the identified tools were not adapted to screening because of low sensitivity and late identification of abused children when they have already serious consequences of maltreatment.

Because of the importance of early detection in 2000 the ED of the Academic Medical Center (AMC) in Amsterdam implemented a Dutch checklist, the SPUTOVAMO checklist (from here on referred to as SPUTOVAMO, see Table 4), with 9 risk factors in order to detect CAN. Although SPUTOVAMO to date has not been formally validated its nationwide implementation, or variations on SPUTOVAMO, has been made mandatory in 2009 by the Dutch Health Care Inspectorate.

During the time period in which this thesis was written two other Dutch accuracy studies by Louwers and Sittig took place. Louwers estimated the accuracy of a 6 item screening instrument, Escape, for detecting potential CAN in children 0-18 years old visiting 3 Dutch EDs and estimated a PPV of 0.10 and a NPV of 0.88. Diagnosis was first made by CAN Teams of the 3 hospitals. Subsequently, to establish whether or not these cases were CAN teams were independently evaluated by an expert panel consisting of four physicians with extensive experience in child abuse, of which one was a forensic pediatrician and two were pediatricians. The instrument does compromise a full physical examination, it is unclear in how many instances this complete examination was actually performed. Sittig estimated the accuracy of the SPUTOVAMO-R questionnaire; also a 6 item screening instrument...
### Table 4. Dutch SPUTOVAMO checklist

The 9 questions on the Dutch SPUTOVAMO checklist^  

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which type of injury? (contusion, stab wound, burn, cut et cetera)</td>
<td>Is this a normal place for this kind of injury? [ ] yes [ ] no*</td>
</tr>
<tr>
<td>Which place? (construct drawing)</td>
<td>Does the injury look usual? [ ] yes [ ] no*</td>
</tr>
<tr>
<td>What are the external characteristics of the injury? (color, form, border, etcetera)</td>
<td>Does the appearance of the injury fit with the stated age? [ ] yes [ ] no*</td>
</tr>
<tr>
<td>When did the accident happen? How much time ago?</td>
<td>Does the explanation fit with sort, place and appearance of the injury? [ ] yes [ ] no* [ ] doubtful*</td>
</tr>
<tr>
<td>What was the cause of the accident? What explanation is given?</td>
<td>Is this person present in the ED? [ ] yes [ ] no*</td>
</tr>
<tr>
<td>Who caused the accident?</td>
<td>Are the witnesses present in the ED? [ ] yes [ ] no* [ ] not applicable</td>
</tr>
<tr>
<td>Were witnesses present? Who?</td>
<td>Were the undertaken measures appropriate? [ ] yes [ ] no* Why not?</td>
</tr>
<tr>
<td>What measures were taken by parents, caregivers or others?</td>
<td>Did somebody perform an inspection for old injuries? [ ] yes [ ] no</td>
</tr>
<tr>
<td>Which old injuries can be seen?</td>
<td>Were old injuries found? [ ] yes* [ ] no</td>
</tr>
<tr>
<td>Do you have a suspicion of child maltreatment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^Translation of the Dutch SPUTOVAMO checklist for child maltreatment at the ED. SPUTOVAMO is an acronym in which each letter represents one question on the form.  
* Direct referral for further assessment by specialized pediatrician
compromising a full physical inspection in children aged 0-7 visiting the ED’s of several Dutch hospitals for the detection PA. All SPUTOVAMO-R positives and a 15% random sample of the SPUTOVAMO-R negatives underwent the same systematic diagnostic work up, which consists of an adequate history being taken by a pediatrician, inquiry with other health care providers by structured questionnaires in order to obtain child abuse predictors, and by additional follow-up information. Eventually, an expert panel (reference test) determined the true presence or absence of child abuse. Only 3 cases of PA were found. Sittig et al. estimated a PPV for injuries due to abuse of only 0.03 and a PPV for injuries due to neglect of 0.05 with a NPV of 1.0. The authors conclude that the use of SPUTOVAMO-R ensures detection of PA, although false positive rates are high.\textsuperscript{77}

Implementation of a screening tool can be difficult, given the barriers in ED personnel to screen for CAN like lack of means or time, high turnover of staff, lack of knowledge of CAN, lack of knowledge of communication with parents in case of suspected CAN.\textsuperscript{90} It is known that unsuccessful implementation can lead to association of screening with the family’s socioeconomic status.\textsuperscript{91} Race and ethnicity could also have an effect on willingness to screen.\textsuperscript{92}

Barriers to recognizing and reporting of CAN at the ED do exist, like providers’ desire to believe the caregiver, failure to recognize that a child’s presentation could be due to CAN, challenges innate to working in an ED such as lack of ongoing contact with a family and provider biases.\textsuperscript{93} Barriers to reporting child abuse and neglect include familiarity with the family, factors associated with the reporting process, lack of follow-up of reported cases, and negative consequences of reporting such as testifying in court.\textsuperscript{93,94} Reported facilitators included real-time case discussion with peers or supervisors and the belief that it is better for the patient to report in the setting of suspicion.\textsuperscript{93}

**General outline of this thesis**

*Chapter 2* is an educational paper which provides the reader with an overview of the current screening methods for CAN at the ED.

*Chapter 3* describes the results of the implementation of a new screening protocol for child maltreatment at the ED of the Academic Medical Center (AMC) in Amsterdam directly after introduction (February 2010) and 9 months later. This protocol consists of adding a so called ‘top−toe’ inspection (TTI), an inspection of the fully undressed child, to the screening checklist for child maltreatment, the SPUTOVAMO.
Chapter 1

Chapter 4 describes the actual accuracy of this new screening protocol for CAN at the ED of the AMC in Amsterdam during the study period of 2 ½ years (January 1st, 2011 till July 1st, 2013). The aim of this study is:
1. To estimate the implementation of both SPUTOVAMO and TTI for CAN screening at the ED of the AMC;
2. To estimate the diagnostic accuracy of both the individual screening tests (SPUTOVAMO and TTI) and the combination of these screening tests in this large urban ED; and -in addition-
3. To estimate the accuracy of the individual SPUTOVAMO questions.

Our special interest lies in the additional number of patients with a final diagnosis of CAN, who are recognized by adding the TTI to the SPUTOVAMO (false negative SPUTOVAMO) and the false positive TTI's. The results of this study can be used to design guidelines on screening for CAN at EDs.

Chapter 5 gives an overview of diagnoses and interventions of the CAN Team in the AMC, a teaching hospital in Amsterdam. We describe the number and characteristics of the cases reported to our team in 2010-2012.

Chapter 6 is a systematic review showing the evidence for using a screening physical examination to detect CAN. We included studies published before August 9th, 2013.

Chapter 7 describes the results of a survey across all hospital EDs accessible to children in the Netherlands between November 1st 2012 and March 12th 2013 describing the varying policies used to screen for CAN in Dutch EDs.

Chapter 8 is a written questionnaire study describing parents’ opinion about a routine head-to-toe examination of children as a screening instrument for CAN in children visiting the ED of the AMC during the study period, from April 1 to May 31, 2013. It also includes a systematic review on parental acceptability of screening for CAN.

In chapter 9 we discuss in which situations and under which conditions personal data of children may be used for a study without obtaining consent. In doing so, we make use of two recent studies, performed in the AMC.

In chapter 10 the dissertation ends with a summary and discussion of the main results, providing future perspectives on clinical practice and research.
REFERENCES


Chapter 1


