

**Child Abuse:  
The Value of Systematic Screening  
at Emergency Rooms**

Judith Susannah Sittig

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# **Child Abuse: The Value of Systematic Screening at Emergency Rooms**

Kindermishandeling:  
de waarde van systematische screening  
op Spoedeisende Hulpen  
(met een samenvatting in het Nederlands)

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## **Article 19**

1. States Parties shall take all appropriate legislative, administrative, social and educational measures to protect the child from all forms of physical or mental violence, injury or abuse, neglect or negligent treatment, maltreatment or exploitation, including sexual abuse, while in the care of parent(s), legal guardian(s) or any other person who has the care of the child.
  
2. Such protective measures should, as appropriate, include effective procedures for the establishment of social programmes to provide necessary support for the child and for those who have the care of the child, as well as for other forms of prevention and for identification, reporting, referral, investigation, treatment and follow-up of instances of child maltreatment described heretofore, and, as appropriate, for judicial involvement.

'Convention on the Rights of the Child, New York, 20 November 1989'



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# CHAPTER 1

## **General introduction**

## **GENERAL INTRODUCTION**

Already in 1962 Kempe et al.(1) published their description of “the battered-child syndrome” and made an appeal about child abuse being a paediatric and public health problem. Since then, much effort has been spent to improve recognition and timely and effective intervention of child abuse. Nevertheless, to date child abuse remains a major international health problem as recognized by the World Health Organization(2) with unacceptable levels of morbidity and mortality.(3)

Maltreated children, particularly physically abused children, may present at hospital emergency rooms (ERs). It is highly important that ER professionals provide adequate early detection and intervention for abused children, since the consequences of both missed child abuse cases and wrong suspicions are substantial. A missed diagnosis may have enormous influence on education, mental health, physical health, and violence or criminal behaviour.(4) On the other hand, inaccurate suspicions may have big impact on children and their families.

There are indications that in hospitals complying with diagnostic guidelines for suspected child abuse the detection rates are higher than in those not complying.(5) Many ERs have implemented diagnostic guidelines for the detection of child abuse, typically general instruments like short inventories to be used for all presenting children and not only those with a suspicion of child abuse. However, evidence on the accuracy of these child abuse detection instruments is still lacking.

This thesis describes the results of the large diagnostic study called ‘Child Abuse Inventory at Emergency Rooms’, CHAIN-ER, that aimed to examine the diagnostic accuracy of the Dutch child abuse detection instrument SPUTOVAMO-R.

### **Forms of child abuse**

Child abuse encompasses any acts of commission or omission by a parent or other caregiver that result in harm, potential for harm, or threat of harm to a child, even if harm is not the intended result.(6) Physical abuse, sexual abuse, psychological abuse, neglect and witnessing intimate-partner violence are all widely recognized forms of child abuse (table 1).

CHAIN-ER focuses on the (early) detection of physical abuse at the ER since many children will attend the ER with physical injuries. Physical abuse is defined as ‘use of physical force or implements against a child that result in, or has the potential to result in physical injury’.(6) To see whether the SPUTOVAMO-R checklist could correctly detect

**Table 1.** Definitions of child abuse (based on Centers for Disease and Prevention report 2008)

<b>Child abuse</b>	Any acts of commission or omission by a parent or other caregiver that result in harm, potential harm, or threat of harm to a child, even if harm is not the intended result
<b>Physical abuse</b>	Intentional use of physical force against a child that result in, or has the potential to result in, physical injury
<b>Sexual abuse</b>	Any completed or attempted sexual act, sexual contact, or non-contact sexual interaction with a child by a caregiver
<b>Psychological abuse</b>	Intentional behaviour that conveys to a child that he/she is worthless, flawed, unloved, unwanted, endangered, or valued only in meeting another's need
<b>Neglect</b>	Failure to meet a child's basic physical, emotional, medical/dental, or educational needs; failure to provide adequate nutrition, hygiene, or shelter; or failure to ensure a child's safety
<b>Intimate-partner violence</b>	Any incident of threatening behaviour, violence, or abuse (psychological, physical, sexual, financial, or emotional) between adults who are, or have been, intimate partners or family members, irrespective of sex or sexuality

children with injuries due to neglect, we used injury due to neglect as secondary outcome measure, defined as 'failure to meet a child's basic physical needs or failure to ensure child's safety'.(6)

## Prevalence

The true prevalence of child abuse is difficult to assess, because cases often remain hidden to health care professionals, but also because professionals do not always report all cases they recognise.(7) The prevalence estimates by studies based on self-reported incidents of child abuse are much higher than the numbers reported by health care professionals. (4, 8, 9) Based on self reports, in high-income countries every year about 4-16% of children are physically abused and one in ten is neglected or psychologically abused. (4) In the Netherlands, the estimated prevalence of child abuse is 34 per 1000 children based on reports of professionals of any kind working with children and based on data from the Dutch Child Protection Services. Approximately 7% of all reports to the Dutch Child Protection Services (Advies- en Meldpunt Kindermishandeling) are substantiated as physical abuse.(10)

Child abuse as a cause of injury is estimated to be 1% or less of the injured children attending the ER.(11) Boys and girls are equally likely to be victims of physical abuse.(12)

## Diagnostic instruments

Internationally, several diagnostic instruments or strategies for child abuse detection are used at ERs,(12-20) such as checklists, protocols and scoring systems, sometimes restricted to particular characteristics e.g. age, type of injury, repeated attendance, or a medical history inconsistent with the injury. Comprehensive evidence on the accuracy of all these instruments, however, is still lacking.(21, 22)

For example, in the UK the checklist of Bengner et al.(20) is regularly used. Four questions regarding the injury should lead to an accurate distinction between physical child abuse suspicion and non-suspicion. The authors concluded that inclusion of the checklist increased the awareness, consideration and documentation of suspected abuse.(20) However, numbers of confirmed abuse were not reported and therefore the accuracy and the effectiveness of the Bengner checklist could not be investigated.

Pless et al.(14) introduced a case-finding system using a checklist (Accident-SCAN) to remind the attending nurse and physician to consider the possibility of maltreatment in the aetiology of each apparent accident. In their study, for 1,563 children aged under 6 years attending at the ER the Accident-SCAN was completed. Thirty-six (2.3%) patients were suspected to be victims of abuse or neglect after completing the Accident-SCAN. In 70% of these screen positives the diagnosis of child abuse or neglect was assessed. However, it is not clearly described how this diagnosis was established. Furthermore, the study showed a non-significant increase of confirmed cases of abuse. The authors concluded that either implementation of the checklist was not sufficient to increase the detection rate, or the ER staff was already focused on the detection of child abuse.

In the study of Chang et al.(19) 171 cases (i.e. 1.4% of the paediatric trauma population at the John Hopkins Hospital) of child abuse were identified from a trauma registry. Child abuse cases and their perpetrators were identified by External Injury Codes (E-codes). These codes indicate different types of injury. Again, it is not sufficiently described how professionals performed these codes. Retrospectively, variables of the 171 abused children were compared with 11,748 non-abused children. Aim of the study was to develop a clinically useful diagnostic tool from all variables with a significant association to abuse. Eventually, they constructed a 26-point and 15-point index named Diagnostic Index for Physical Child Abuse (DIPCA) or Screening Index for Physical Child Abuse (SIPCA). Factors included in the SIPCA tool are age, and patters of injury (including fracture of base or vault of skull, contusion of eye, rib fracture, intracranial bleeding, multiple burns). The SIPCA tool is validated in a independent dataset.(19) However, this tool has never been validated in a prospective study.

### The SPUTOVAMO checklist

In 2007, the Dutch Health Care Inspectorate has evaluated child abuse detection procedures at ERs of all Dutch hospitals and judged them inadequate.(23) Consequently, it formulated a set of child abuse detection requirements for each hospital. One of these requirements is the use of a child abuse detection instrument such as the commonly used SPUTOVAMO checklist. SPUTOVAMO is an acronym composed of the first letters of 9 questions regarding the injury. This checklist, originally developed by Compernelle(17) in 1996, has been spread nationwide and as a consequence more than 30 variants are currently being used.

In line with the internationally used child abuse detection instruments, the value of SPUTOVAMO has never been properly investigated. As an indication for false negatives, a Dutch study showed that out of 36 verified child abuse cases that had earlier attended an ER, 10 (28%) were not detected as such at the ER.(24) Moreover, as an indication for false positive rates, of all positive SPUTOVAMO's registered in the Wilhelmina Children's

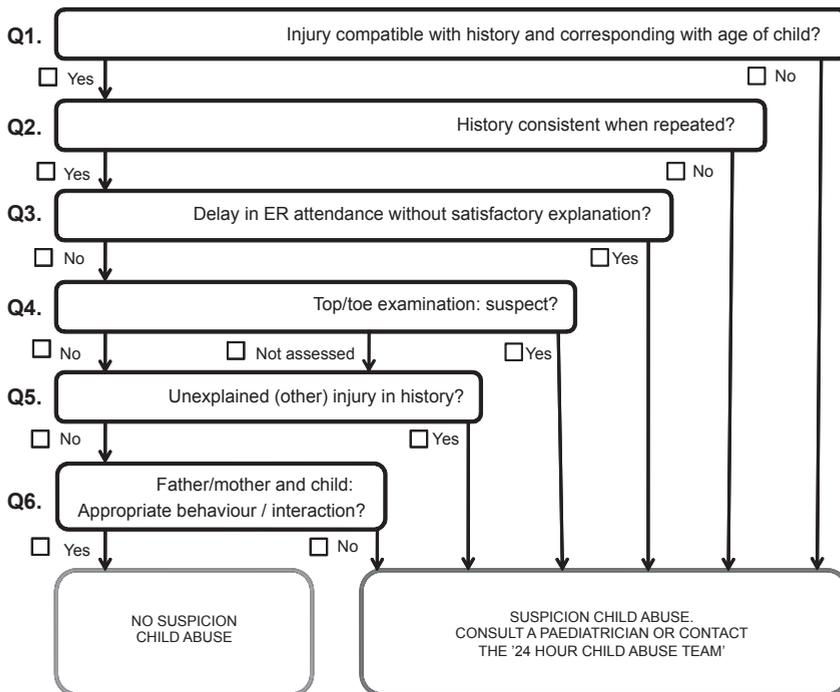


Figure 1. SPUTOVAMO-R

Hospital, University Medical Centre in Utrecht, the Netherlands, in the first trimester of 2009, only 25% could be confirmed as child abuse cases.(25)

For the study described in this thesis, CHAIN-ER, we modified SPUTOVAMO into the more easy to use SPUTOVAMO-R (figure 1), with 6 binary answer possibilities pointing unambiguously at the suspicion of child abuse or not. This SPUTOVAMO-R is quite similar to the instrument of Bengter et al.(20)

### **Training**

Child abuse educational programmes have been designed to improve clinical performance by improving knowledge and skills and by changing attitudes of health care professionals.(26, 27) Interventions such as the introduction of flowcharts and web-based training programmes positively influence knowledge of, and attitudes to the recognition of child abuse.(20, 28) An active learning environment which has received increasing attention is electronic learning (e-learning) and includes applications and processes such as web-based and computer-based teaching.(29) In the setting of an ER with irregular working schedules for professionals, an innovative educational intervention such as e-learning, may be an effective method.(30) It is against this background we have designed a study that evaluated the effectiveness of an e-learning programme, called The Next Page, on the performance of nurses in the recognition of child abuse in the ER.(27) All ER personnel participating in the CHAIN-ER study has been trained by this e-learning programme.

### **Principles of diagnostic research**

To supply evidence on diagnosing abuse among children attending ERs with a physical injury, solid diagnostic research was needed. A key objective in the scientific evaluation of any diagnostic test (so-called index test) is to determine its accuracy – its ability to discriminate between patients who truly have the target condition, here physical abuse, or not. In studies of diagnostic accuracy, results of the index test are compared with results of a reference standard or method. The reference standard needs to provide the highest possible certainty about the target condition being present or not.(31, 32) Suppose that the value of a new diagnostic instrument for child abuse, the index test, was to be assessed at hospital ERs. Clearly, there is no unequivocal reference standard or method for this diagnosis, which poses a considerable challenge to diagnostic research in this setting. In practice, the diagnosis of physical child abuse is commonly based on the presence of (specific) injuries and the absence of a compatible history given by caretakers, commonly

confirmed by consensus in a multidisciplinary assessment. Hence the choice of such consensus judgment by an expert panel as reference standard in the CHAIN-ER study.

### **Aim**

The main aim of the CHAIN-ER study was to assess among children presenting with physical injury at Dutch ERs, the diagnostic accuracy of the nationally implemented SPUTOVAMO-R checklist for detection of physical abuse as primary outcome, and for neglect and need for help from social services as secondary outcome.

## **OUTLINE OF THIS THESIS**

**Chapter 2** shows a randomised controlled trial that aimed to evaluate the effectiveness of the electronic learning programme 'The Next Page' on the performance of nurses in the recognition of child abuse at the ER.

**Chapter 3** shows a descriptive study on the current strategy of child abuse detection at academic ERs.

**Chapter 4** provides a detailed description of the design of the CHAIN-ER study. This aided in the transparency of the research underlying this thesis.

**Chapter 5** describes the main results of the CHAIN-ER study.

**Chapter 6** provides a general discussion including suggestions for future research.

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## CHAPTER 2

# **Successful e-learning programme on the detection of child abuse in Emergency Departments: a randomised controlled trial**

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*Arch Dis Child* 2011;96:330-334

## **ABSTRACT**

### **Objective**

To evaluate the effectiveness of an electronic learning (e-learning) programme on the performance of nurses in the recognition of child abuse in a simulated case in the emergency department (ED).

### **Design**

Blinded, randomised controlled trial using pre- and post-intervention design.

### **Setting**

The ED of a University Medical Centre in the Netherlands.

### **Participants**

38 ED nurses were included, 25 nurses were analysed.

### **Intervention**

Half of the participants followed a 2-h e-learning programme focused on the recognition of child abuse, the others acted as a control group.

### **Main outcome measurements**

Individual performance during a case-simulated parent interview to detect child abuse and self-reported self-efficacy for the detection of child abuse. Performance on the simulation was scored by an expert panel using a standardised assessment form which was designed to score quantity and quality of the questions posed by the nurse (minimum score 0; maximum score 114).

### **Results**

During post-test, nurses in the intervention group performed significantly better during the simulation than the control group, (89 vs 71, 95% CI 2.9 to 33.3), and reported higher self-efficacy (502 vs 447, 95% CI -25.4 to 134.7). Performance in detecting child abuse correlated positively with the self-efficacy score (Spearman correlation 0.387, p value 0.056). Comparing post- and pre-test results separately for the intervention and the control group showed an almost significant increase in performance in the intervention group.

## **Conclusion**

E-learning improved the performance in case simulations and the self-efficacy of the nurses in the ED in the detection of child abuse. Wider implementation of the e-learning programme to improve the first step in the detection of child abuse is recommended.

## **Trial registration**

Protocol registration system of [clinicaltrials.gov](https://clinicaltrials.gov): NCT00844571

## **INTRODUCTION**

The discrepancy between child abuse officially recognised by child protection services and the prevalence of abuse based on self-reports of children in community surveys indicates that there are frequent failures in the recognition of child abuse.(1-4) In the Netherlands, hospitals contribute to only 6% of all reports to child-protection services, while international data indicate that 8% of reports come from hospitals.(3;5) One of the screening instruments used to ensure that child abuse is considered in the Emergency Department (ED) of a hospital is a checklist for all children attending the department. In the Netherlands, a child abuse checklist called SPUTOVAMO has been widely introduced in EDs. SPUTOVAMO is an acronym composed of the first letters of 9 questions regarding the injury. This checklist, originally developed by Compernelle (6) in 1996, was revised in a checklist with 6 questions with binary answer possibilities (SPUTOVAMO-R) pointing unambiguously at the suspicion of child abuse or not. This SPUTOVAMO-R is quite similar to the detection instrument of Benger and Pierce and it contains questions designed to explore the initial injury/complaint, the consistency of the history, delay in presentation, top/toe examination, previous injuries and the interaction of the parents and the child (see figure 1).(7)

ED professionals complete the screening instrument and the result of this first step in the process of recognition of child abuse will predominantly determine the consecutive work-up for the potentially maltreated child. The presence of ED staff with the necessary knowledge, skills and attitudes is therefore a key component in the recognition of child abuse.(8) Educational programmes have been designed to improve clinical performance by improving knowledge and skills and by changing attitudes.(9) Interventions such as the introduction of flowcharts and web-based training programs positively influence knowledge of, and attitudes to the recognition of child abuse.(7;10) An active learning

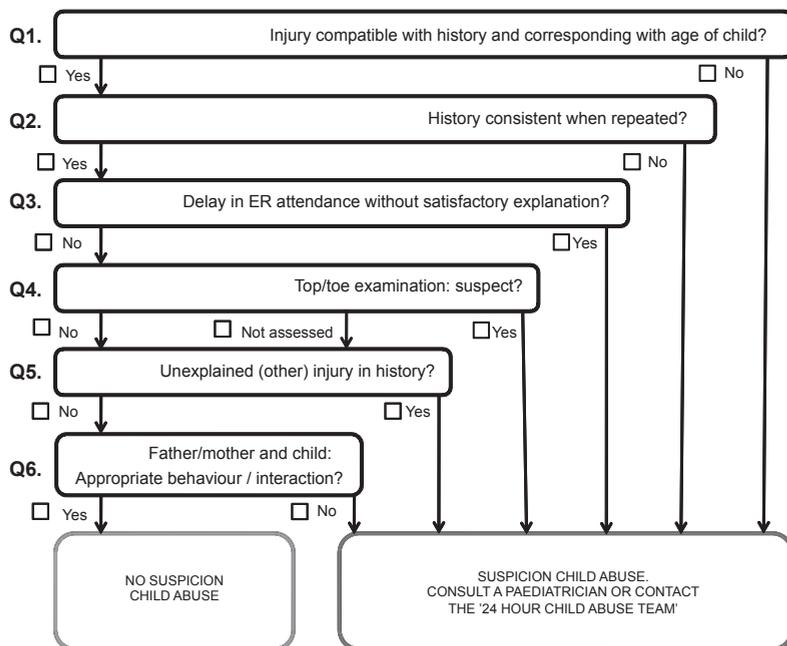


Figure 1. SPUTOVAMO-R

environment which has received increasing attention is electronic learning (e-learning) and includes applications and processes such as web-based and computer-based teaching.(11;12) E-learning promotes self-directed learning, reduces the required learning time and offers time-flexibility for the learners. Studies show that e-learning programme for nurses can be at least as effective as face-to-face teaching.(11-13) In the setting at an ED with irregular working schedules for professionals, an innovative educational intervention such as e-learning, may be an effective method.(14)

Self-efficacy is another important aspect of learning and is defined by Bandura as “a person’s belief in their capabilities to organize and execute the course of action required to produce given attainments”.(15) The higher a person’s self-efficacy in respect of a particular task the more likely they are to perform it.

A change in the performance in the recognition of child abuse, after an educational intervention, as a measurement of the integration of knowledge and attitude, has never been reported.(3;4;16;17) Only one educational programme has been evaluated using

a randomised controlled design, with documentation of child abuse as an outcome measure.<sup>(14)</sup> This educational programme did not lead to improved documentation regarding physical child abuse in the ED setting.

Our study is performed in an ED of a University Hospital in the Netherlands. The ED has a paediatric unit with an annual attendance of 4000 patients under the age of 18 years. SPUTOVAMO-R is filled out for all patients under the age of 18 years attending the ED (this is a compulsory field in the electronic file of the medical records of the patient under the age of 18 years). Suspicion of child abuse is present in 2.8%, with a higher percentage in the younger age group (3.7% under the age of 7). A suspicion of child abuse by the nurse (positively screened SPUTOVAMO-R) is followed by a systematic work-up for possible child abuse starting with a paediatric consultation in the ED. After the work-up, all screened positive cases are discussed in the multidisciplinary Child Abuse Team in the presence of the Child Protection Services.

The aim of our study was to evaluate the effectiveness of an e-learning programme on the recognition of child abuse in terms of the effect on both the performance during a case-simulation and on self-efficacy in a randomised controlled trial. Verification of the efficacy of this programme would support the wider use of e-learning programmes to improve the first step in the recognition of child abuse.

## **PATIENTS AND METHODS**

### **Study design and timetable**

A randomised controlled trial was performed using a pre- and post-intervention design. The pre-test was conducted in all participants from August to October 2008. The post-test was performed in the control group in April 2009, 2 weeks before the launching of the intervention programme, and in the intervention group 2 weeks after the launching of the programme. The trial had to be finished before May 2009, after which the trial would be confounded as all ED nurses were then scheduled to receive additional training in the recognition of child abuse following a directive of the Dutch Health Care Inspectorate.

### **Intervention**

The intervention was an e-learning programme on child abuse known as The Next Page developed by the non-profit Augeo foundation ([www.thenextpage.nl](http://www.thenextpage.nl)). The programme consists of three different modules, recognition, acting and communication. Our study

focuses only on the first of these modules which was specifically developed to improve recognition of child abuse by nurses in the ED. The e-learning programme contains simulations of clinical cases, video-animations and interactive elements. Participants were instructed to complete the programme in a minimum of 2 h during a 2-week period either at the hospital or at home. Participants were allowed to access the e-learning programme more often than the obliged 2 h after they obtained access.

### **Participants and randomisation**

The study was carried out among nurses at the ED of the University Medical Centre Utrecht, the Netherlands. Utrecht is one of the largest cities in the Netherlands with 300.000 inhabitants. Thirty-eight nurses had a permanent contract in the department during the study period and were included in the study. During randomisation, participants were allocated to an intervention or a control group using a computer-generated randomisation list created by an independent statistician. Owing to the nature of the trial it was not possible to blind the participants and the head researcher to randomisation.

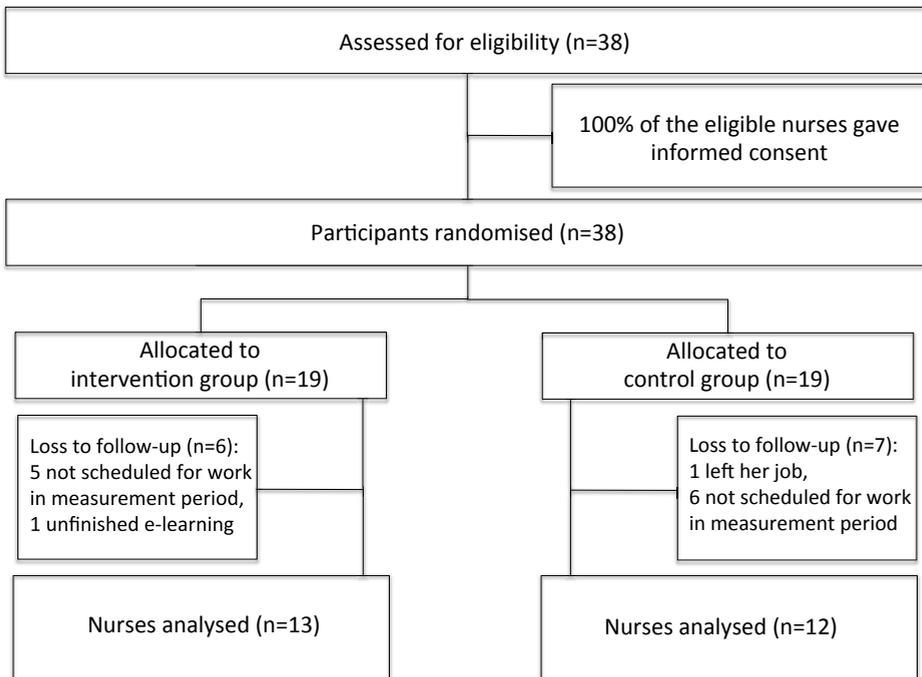
### **Outcome measures**

In all participants (intervention and control) performance in simulated cases was measured as the primary outcome and self-efficacy as the secondary outcome. Outcome measures were determined at baseline (pre-test) and after the intervention group had been trained (post-test). An expert panel of 3 paediatricians experienced in the recognition of child abuse, who were blinded to the allocation, evaluated the recorded performance. Baseline characteristics of the randomised participants were collected and are presented in table 1. Figure 2 shows the flow of participants through the trial and reasons for loss to follow-up.

### ***Primary outcome measurement: performance in simulated cases***

We designed eight simulated cases – based on real clinical cases and ranging in age from 9 month to 5 years – attending the ED for injuries such as bruises, fractures and unconsciousness with varying histories (fall from stairs, fall from a height, unknown event). The top/toe examination was simulated by showing pictures of the undressed child when the nurse announced the necessity of this examination.

During both the pre- and the post-test participants were tested with one case simulation, and were asked to obtain all information necessary to complete SPUTOVAMO-R (figure 1). For each case simulation all items of the six-point checklist had to be scored.



**Figure 2.** Flow of the participants through the trial and reasons for loss to follow-up

The final conclusion of the participant on the suspicion of child abuse and duration of each interview were also recorded. The injury in the case simulation was more often inflicted than accidental (proportion 2:1). The primary researcher (AEFNNS) listed the case simulations which were applied during the pre-test to avoid repeating these in the post-test. Three persons took part in the simulation test: the study participant, a scenario leader and an actor in the role of the parent with a doll to represent the patient. After each case simulation, the participants received immediate structured feedback from the scenario leader.(18)

The case-simulations were recorded on video and, after the completion of pre- and post-test, the blinded expert panel scored the performance using a standardised assessment form which was designed to score quantity and quality of the questions posed by the nurse (minimum score 0; maximum score 114). One to three questions per item of the six-point checklist had to be asked to be able to make the decision for that item.

### **Secondary outcome measurement: self-efficacy**

Self-efficacy in respect of the detection of child abuse was evaluated using a 100 mm, visual analogue scale (VAS) with anchor bars, consisting of eight statements such as: 'Indicate to what extent you feel able to determine the consistency of the given history'. These statements correspond to the items of the checklist on child abuse. For each individual a total self-efficacy score was calculated by summing the eight individual VAS scores (total VAS-score, min. 0 mm, max. 800 mm).(19) Self-efficacy was measured in all participants immediately before the simulation test.

### **Statistical analysis**

Distribution was judged on the basis of graphical representation of the data. Student's t test was used for apparently normally distributed data. Other data were analysed using non-parametric tests, to assess differences between the groups. An inter-rater reliability analysis using the intraclass correlation coefficient was performed to determine consistency among the members of the expert panel. The collected data were analysed using SPSS version 17.0 for Windows. We considered a p value of  $\leq 0.05$  to be statistically significant.

To account for loss to follow-up, both an intention to treat analysis with the pre-test score carried forward and a multiple imputation analysis were performed. As the results were not essentially altered by these analyses we decided to present the analysis of the participants who performed the post-test.

### **Role of the funding source**

The study was partly funded by the Augeo Foundation. The funders had no part in the design of the study; collection, analysis and interpretation of the data; the writing of the report; or the decision to submit the article for publication.

## **RESULTS**

### **Subjects**

No significant differences in nurses' characteristics were seen between the control and the intervention group (table 1). Comparing the lost to follow-up and the analysed participants, no differences were seen at baseline (table 2).

**Table 1.** Baseline characteristics of study participants. Values are means (SD) unless stated otherwise.

	Intervention Group (n=19)	Control Group (n=19)	p Value (CI 95%)
Female (n)	15	15	
Mean Age (years)	41 (9)	41 (11)	0.961 (-6.4 to 6.7)
Mean Work experience (years)	9 (9)	9 (9)	0.753 (-4.3 to 5.8)
Mean VAS pre-test self-efficacy score (0-800)	395 (92)	403 (144)	0.847 (-72.2 to 87.4)
Mean pre-test performance score (0-114)	74 (18)	66 (25)	0.280 (-22.0 to 6.6)
Duration of the case simulation (s)	544 (152)	534 (143)	0.842 (-87.4 to 106.7)

**Table 2.** Baseline characteristics of analysed participants and participants that were lost to follow-up. Values are means (SD) unless stated otherwise.

	Analysed participants (n=25)	Lost to follow up (n=13)	p Value (CI 95%)
Female (n)	18	12	
Mean Age (years)	42 (9)	39 (12)	0.451 (-4.3 to 9.4)
Mean Work experience (years)	9 (7)	9 (9)	0.977 (-5.4 to 5.2)
Mean VAS pre-test self-efficacy score (0-800)	384 (111)	429 (132)	0.273 (-127.4 to 37.1)
Mean pre-test performance score (0-114)	71 (21)	67 (24)	0.559 (-10.8 to 19.7)
Duration of the case-simulation (s)	546 (160)	536 (141)	0.841 (-112.4 to 92.1)

## Effect of intervention

### *Performance during case simulations*

Complete data were available for 25 nurses: 12 nurses in the control group and 13 in the intervention group. The total performance during post-test of the intervention group was significantly better than that in the control group, indicating that more adequate questions were asked resulting in a higher quality of history taking (p value: 0.022). Analysis per item of the six-point checklist and duration of the test is shown in table 3. Some components of the checklist did not improve at all, for example, the evaluation of interaction between parent and child. The final conclusion (suspicion of child abuse yes or no) of the nurse is often in line with the intended conclusion of the scenarios, both in the intervention group and in the control group (table 3).

Comparing post- and pre-test results separately for the intervention and the control group showed almost significant increase in performance in the intervention group but not in the control group (table 4). A positive correlation is seen between the duration of

**Table 3.** Participants' mean scores (SD) on adequate questions regarding possible child abuse during case simulations and the VAS total self-efficacy score (n=25)

	Intervention group: n=13	Control group: n=12	p Value (95% CI)
Evaluate injury in the context of the explained history (range 0-24)	18 (6)	15 (4)	0.127 (-0.9 to 6.9)
Evaluate consistency of the history (range 0-18)	14 (4)	9 (5)	0.013*
Evaluate if there is a delay in presentation (range 0-24)	20 (5)	18 (5)	0.359 (-2.2 to 5.9)
Evaluate the physical examination (range 0-18)	17 (1)	14 (5)	0.056*
Evaluate history of past injuries (range 0-18)	13 (5)	8 (6)	0.053*
Evaluate interaction parents-child (range 0-12)	7 (4)	6 (4)	0.763*
Total performance score (range 0-114)	89 (19)	71 (18)	0.022 (2.9 to 33.3)
Expert agreement with the final conclusion child abuse (range 0-3 (3 = complete agreement) )	3 (1)	2 (1)	0.363*
VAS total self-efficacy score ** (range 0-800)	502 (96)	447 (98)	0.171 (-25.4 to 134.7)
Duration of case simulations (s)	662 (222)	464 (149)	0.017 (39.5 to 355.2)

Results during post-test

\* Mann-Whitney U test. \*\* VAS total self-efficacy score: total of all individual VAS scores

**Table 4.** Comparing post- and pre-test results separately for the intervention and the control group

		Pre-test results	Post-test results	p Value (95% CI)
Intervention group, n=13	Total performance score (range 0-114)	74 (19)	89 (19)	0.053 (-29.7 to 0.2)
	VAS Total self-efficacy score (range 0-800)	402 (75)	502 (96)	0.000 (-146.5 to -54.2)
Control group, n=12	Total performance score (range 0-114)	69 (23)	71 (18)	0.728 (-15.5 to 11.2)
	VAS Total self-efficacy score (range 0-800)	364 (142)	447 (98)	0.045 (-164.4 to -2.1)

the simulation test and the total number of adequate questions (Spearman correlation 0.586, p value 0.002). The inter-rater reliability for the three experts during post-test was found to be 0.70 (95% CI 0.51 to 0.84, p value 0.000), which can be considered good. (20)

### **Self-efficacy**

The mean total post-test self-efficacy score was 502 in the intervention and 447 in the control group (95% CI of the difference -25.4 to 134.7) (table 3). There was a positive correlation between the total self-efficacy score and the performance on the simulation test (Spearman correlation 0.387, p value 0.056). Comparing post- and pre-test results separately for the intervention and the control group showed a significant increase of the self-efficacy score in both groups (table 4).

## **DISCUSSION**

This randomised controlled trial demonstrated improved performance in the first step in the recognition of possible child abuse during a simulation test of a child attending the ED by ED nurses after following an e-learning programme. Nurses trained with this programme asked more adequate questions to determine suspicion on child abuse. This is a positive finding which might lead to the identification of more abused children. Furthermore, asking more of the right questions might decrease the false positive rate. In our hospital only 40% of the initially screened positives for child abuse are eventually referred for an intervention, on the basis of a strong suspicion or confirmation of child abuse. The present study only evaluates the first step in the process of recognition of child abuse in a case-simulation setting. The actual accuracy of the SPUTOVAMO-R for the diagnosis physical child abuse is now being investigated in a diagnostic study CHAIN-ER (Child Abuse Inventory at Emergency Rooms). First results from this study are expected in 2011.

Ideally one would like to evaluate the effect of better recognition in the ED on the outcome of abused children. This requires well-designed, large-scale studies in which all the different steps resulting in an operational defined better outcome for abused children are evaluated (reporting to Child Protection Services, start of appropriate interventions, adherence to interventions, outcome, etc). For our study we decided to administer a proximal test to determine the effect of an educational programme on the recognition of child abuse, a test that specifically evaluates that aspect which the intervention was designed to improve. We used an objective measurement of effect as we felt this to be more reliable than self-reported improvements in recognition as was done in other studies.(21;22) Interestingly, both groups made a reasonable final decision on the suspicion of child abuse, even though the scores for separate questions were lower in the

control group. This reflects the fact that child protection assessment is multifaceted and relies not just on answers to the correct questions of a screening instrument.

This study had several limitations: first, we chose to include all nurses with a permanent ED contract to minimise loss to follow-up but this policy did not prevent a drop-out rate of 36% due to participants' shift pattern. We have no indications for selective drop-out, but this high drop-out rate might limit the generalisability of the findings. Another limitation of the study is the use of case-simulation rather than observations of clinical practice. For example, due to the simulated setting the interaction between parent and child is hard to represent and this could have influenced the outcome of that particular item. However, by using simulations of real anonymised cases of potential child abuse the measurement of performance approaches reality and translation of the results to the clinical performance in the ED seems reasonable. Furthermore, the ability to use analogous patients in the case-simulation allows comparability between participants and the potential to reveal differences between the groups. Simulation also avoids ethical issues such as the use of video recording of the performance in the ED with real patients. A third limitation is the fact that the time allowed to accomplish the task was not restricted during the case-simulations, whereas in the actual clinical practice of an ED, time might be a restrictive factor. Other barriers to a high-quality performance on history taking regarding child abuse at an ED are: violent parents, severe injuries requiring immediate actions, fear for false judgments and emotional involvement in the particular case.

The final achievement of the intervention group with a performance and self-efficacy score considerably below the maximum suggests that there might still be more to be achieved in the accuracy of child abuse screening by nurses at EDs. Our study only evaluated the first module of the training programme. The educational programme will be continued with two other modules of *The Next Page* and intensive communication training with actors.

With an investment of 2 h e-learning, performance in a simulated case regarding the recognition of child abuse was measurably improved in nurses working in an ED. Wider implementation of such programmes in the ED and other hospital departments, as well as in schools and primary healthcare, needs to be investigated to improve detection further. Qualified personnel skilled by e-learning are a potentially valuable element in the detection of child abuse together with other modalities such as the use of compulsory checklists.

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## CHAPTER 3

# **Evaluation of suspected child abuse at the ED; implementation of American Academy of Pediatrics guidelines in the Netherlands**

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## **ABSTRACT**

Emergency departments (EDs) are important to detect child physical abuse. A structured approach will contribute to an adequate detection of abused children at the ED. The American Academy of Pediatrics (AAP) provided guidance in the clinical approach to the evaluation of suspected physical abuse in children. In the Netherlands, these American Academy of Pediatrics guidelines have been adopted for the clinical process of child abuse detection. Here, we describe the outcome of the clinical process in the year 2010 with 65 cases of suspected child abuse out of 3660 children presenting at an ED, and we discuss the strengths and pitfalls of this current clinical approach.

## INTRODUCTION

In high-income countries every year about 3 to 16% of children is physically abused, and 10% is neglected or psychologically abused.[1; 2] Of the injured children attending the emergency department (ED), 1% or less is estimated to be physically abused.[3] Although this proportion is small, detection of physically abused children might prevent detrimental influence on education, mental health, physical health, and violence or criminal abuse may prevent further abusive trauma in infants and adults,[4] thus reiterating the importance of detection of child maltreatment at EDs.

It is commonly thought that a structured approach could be useful to adequately detect maltreated children at the ED. In 2007, the American Academy of Pediatrics (AAP) provided guidance in the clinical approach to the evaluation of suspected physical abuse in children.[5] In the Netherlands, these AAP guidelines are adopted in the clinical process. We will describe the outcome of the clinical process in the year 2010 with 65 cases of suspected child abuse out of 3660 children presenting at an ED of an academic hospital.

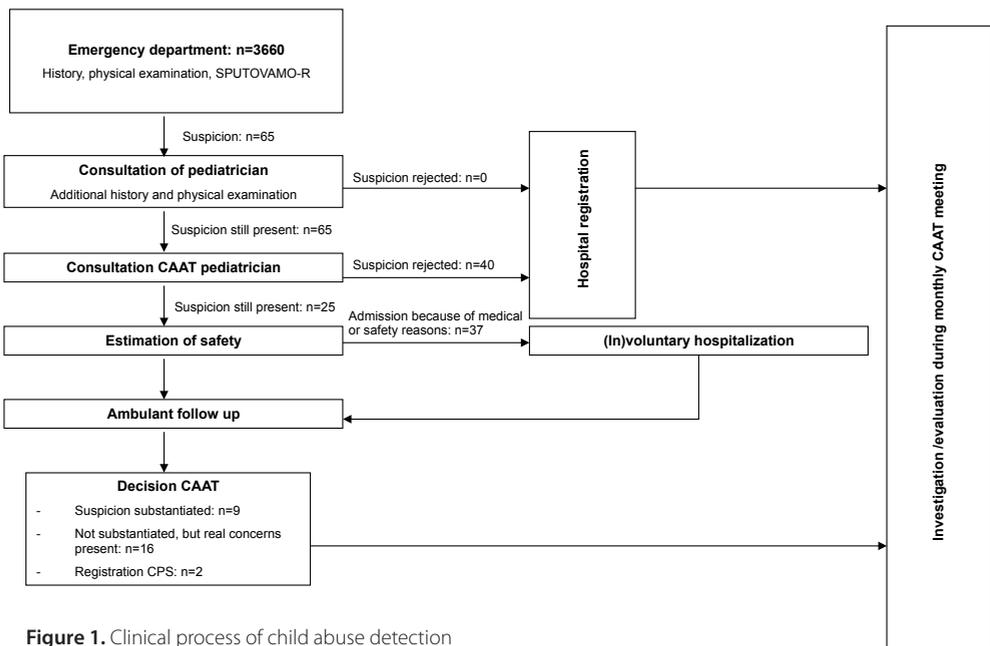


Figure 1. Clinical process of child abuse detection

### CLINICAL PROCEDURE

The clinical child abuse detection procedure at the ED of the University Medical Center Utrecht consists of several steps (figure 1). This detection policy is in line with the requirements of the Dutch Health Care Inspectorate (DHCI),[6] the mandatory code on reporting child abuse of the Royal Dutch Medical Association,[7] and the guidelines of the AAP.[5; 8]

In 2007, the DHCI has evaluated child abuse detection procedures at EDs of all Dutch hospitals and formulated a set of child abuse detection requirements for all hospitals, to be met by the beginning of 2009.[6] One of these requirements is the use of a child abuse detection instrument, for instance, the widely used SPUTOVAMO-R questionnaire (figure 2).

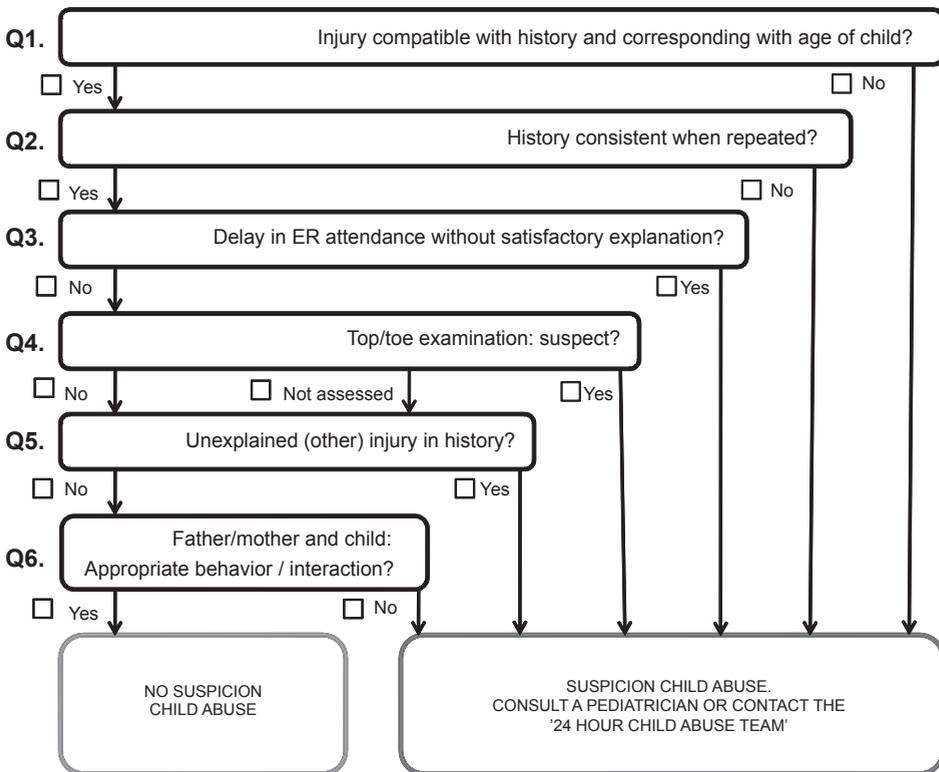


Figure 2. SPUTOVAMO-R

### **Emergency Department**

The diagnostic procedure starts with taking a detailed medical history and performing a physical examination. In 2010, 3660 children (0-18 years) attended the ED because of a medical problem. For every child, an ED nurse and/or physician fill out SPUTOVAMO-R. The result of completing SPUTOVAMO-R will predominantly determine the consecutive work-up for the potentially maltreated child. For all 3660 children SPUTOVAMO-R was filled out (100%). Of these, 65 cases (1.78%) were considered to be suspected for child abuse. Most often (24/65) emotional neglect was suspected (e.g. inadequate parental-child interaction), followed by physical neglect (21/65, e.g. inadequate preventive measures such as the presence of a safety baby gate) and physical abuse (19/65, e.g. inflicted traumatic brain injury).

A positive SPUTOVAMO-R test result is followed by a systematic workup starting with an instant pediatric consultation in the ED. The pediatrician obtains an additional detailed history from the parents or caregivers and -if possible- from the child itself. A full physical examination is performed. The pediatrician is also able to consult a child abuse expert 24/7, a pediatrician specialized in child abuse and member of the hospital Child Abuse Assessment Team (CAAT).

### **Child Abuse Assessment Team**

Suspicions of any form of child abuse are evaluated and eventually rejected or substantiated by the CAAT. The CAAT is a team of pediatricians and other professionals specialized in child abuse (table). Monthly, the CAAT gathers in order to evaluate the management of all recent cases regarding child abuse suspicion. Professionals from other hospitals and primary care can also consult a CAAT pediatrician.

As stated in the AAP guidelines, involving a CAAT early in the process can ensure accurate and comprehensive assessment and sharing of information among the medical and nonmedical disciplines involved. The CAAT can provide intermediate and long-term management of the child and family.[4] In the University Medical Center Utrecht, in approximately 60% of the children with a suspicion of child abuse an intervention was initiated. Of all children, 25% received support from psychologists or social work within our own hospital, and in approximately 35% of the cases, the parents were referred to other organizations, such as pedagogical support institutions, community programs and other resources that will provide effective prevention or intervention.

**Table 1.** Composition of Child Abuse Assessment Team

<b>Composition of CAAT</b>
Pediatrician specialized in child abuse (chairman)
Social worker (coordinator)
Pediatrician (main practitioner)
Pediatric surgeon
Pediatric radiologist
Pediatric psychiatrist and psychologist
Forensic psychiatrist
Emergency physician and emergency nurse
CPS doctor
Advisor forensic medicine
Pediatric dermatologist (on demand)
Lawyer (on demand)

### Follow-up

One of the CAAT's goals is to ensure that the child's immediate medical and safety needs are met. When necessary for medical or safety reasons, the child is admitted to the hospital. If parents do not agree with hospital admission, the child welfare council will ask the judge for a child protection measure. When hospital admission is not needed, the CAAT pediatrician ensures ambulatory follow-up. In 2010, 37 of the 65 children with a suspicion of child abuse were admitted because of medical or safety reasons.

After the workup, in 25 (38%) of the 65 suspected child abuse cases, actual concerns were present and/or were substantiated by the CAAT, and in 60%, any form of extra support was given. When necessary, a case is transferred to child protection services, which happened 2 times (3.1%) in 2010.

## DISCUSSION

Detection of any form of child abuse at an ED is highly important but difficult as well. Our structured child abuse detection approach includes the use of the detection instrument SPUTOVAMO-R. Like with other detection instruments, one of the pitfalls is that the predictive value of this instrument has never been evaluated. In 2010, a minority of the SPUTOVAMO-R positively screened cases were substantiated by the CAAT, which suggests a low specificity and low positive predictive value of this child abuse detection instrument.

Nevertheless, although the predictive value is not known, the use of a detection instrument as part of a detection procedure could be useful. Professionals are urged to be explicitly aware of child abuse as one of the differential diagnoses. Previous studies showed that following a structured child abuse detection procedure could increase the detection rate by improving the awareness.[9-12]

In all situations of suspicions, satisfactory communication with parents or caregivers is crucial. To develop adequate communication skills, educational programs such as The Next Page[13] could be useful. In our hospital, all ED professionals are adequately trained by this educational e-learning program, which is to be translated into English in order to be internationally available soon.

Another strength of the detection procedure is the fact that the percentage of completed SPUTOVAMO-R forms is 100%. Since filling out SPUTOVAMO-R is a mandatory field in our electronic file of all pediatric patients, this ultimate percentage is guaranteed. Before SPUTOVAMO-R was a mandatory field in the medical chart of children, only approximately 34% of the form was filled out. To ensure good quality of assessments, adequate education is crucial because a mandatory field does not necessarily guarantee quality of the assessments.

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## CHAPTER 4

# **Child abuse inventory at emergency rooms: CHAIN-ER rationale and design**

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## **ABSTRACT**

### **Background**

Child abuse and neglect is an important international health problem with unacceptable levels of morbidity and mortality. Although maltreatment as a cause of injury is estimated to be only 1% or less of the injured children attending the emergency room, the consequences of both missed child abuse cases and wrong suspicions are substantial. Therefore, the accuracy of ongoing detection at emergency rooms by health care professionals is highly important. Internationally, several diagnostic instruments or strategies for child abuse detection are used at emergency rooms, but their diagnostic value is still unknown. The aim of the study 'Child Abuse Inventory at Emergency Rooms' (CHAIN-ER) is to assess if active structured inquiry by emergency room staff can accurately detect physical maltreatment in children presenting at emergency rooms with physical injury.

### **Methods/design**

CHAIN-ER is a multi-center, cross-sectional study with 6 months diagnostic follow-up. Five thousand children aged 0-7 presenting with injury at an emergency room will be included. The index test - the SPUTOVAMO-R questionnaire- is to be tested for its diagnostic value against the decision of an expert panel. All SPUTOVAMO-R positives and a 15% random sample of the SPUTOVAMO-R negatives will undergo 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) determines the *true* presence or absence of child abuse.

### **Discussion**

CHAIN-ER will determine both positive and negative predictive value of a child abuse detection instrument used in the emergency room. We mention a benefit of the use of an expert panel and of the use of complete data. Conducting a diagnostic accuracy study on a child abuse detection instrument is also accompanied by scientific hurdles, such as the lack of an accepted reference standard and potential (non-) response. Notwithstanding these scientific challenges, CHAIN-ER will provide accurate data on the predictive value of SPUTOVAMO-R.

## **BACKGROUND**

The World Health Organization has recognized child abuse and neglect as a major international health problem (1) with unacceptable levels of morbidity and mortality (2). Child maltreatment encompasses any acts of commission or omission by a parent or other caregiver that result in harm, potential for harm, or threat of harm to a child, even if harm is not the intended result (3). Four forms of maltreatment are widely recognized: physical abuse, sexual abuse, neglect and emotional abuse. Increasingly, witnessing intimate-partner violence is also regarded as a separate form of child maltreatment (4). In high-income countries, the annual incidence of self-/parent- reported physical abuse is 4-16%, the annual incidence of neglect is 1.4-15.4% and the annual incidence of psychological abuse is 10.3% (4). Although maltreatment as a cause of injury is estimated to be only 1% or less of the injured children attending the emergency room (ER) (5), the consequences of both missed child abuse cases and wrong suspicions are substantial. Missed diagnosis may have enormous influence on education, mental health, physical health, and violence or criminal behavior (6). Besides, inaccurate suspicions also have a huge impact on children and their families. Generally the children with injury caused by child maltreatment that are seen in the ER are the most serious cases of abuse or neglect, thus putting these children at greater risk of subsequent severe maltreatment related injury or death. From a public health perspective, early identification of maltreatment allows children and families to receive intervention to prevent further maltreatment, thus reducing the cost of maltreatment to the individual, the family and the society. As stated by the American Academy of Pediatrics: 'accurate and timely diagnosis of children who are suspected victims of abuse can ensure appropriate evaluation, investigation, and outcomes for these children and their families' (7). For all these reasons, accurate detection of child maltreatment at ER's by health care professionals is highly important.

Internationally, several diagnostic instruments or strategies for child abuse detection are used at ER's (8-14), such as checklists, protocols and scoring systems, sometimes restricted to particular characteristics e.g. age, type of injury, repeated attendance, or a medical history inconsistent with the injury (5;15). For example, in the UK the checklist of Bengner et al. (8) is regularly used. Four questions regarding the injury aim to lead to a distinction between physical child abuse suspicion and non-suspicion. In the Netherlands, a child abuse detection instrument called SPUTOVAMO has been widely introduced at ER's. SPUTOVAMO is an acronym composed of the first letters of 9 questions regarding the injury. This checklist, originally developed by Compernelle (16) in 1996, was revised into a checklist with 6

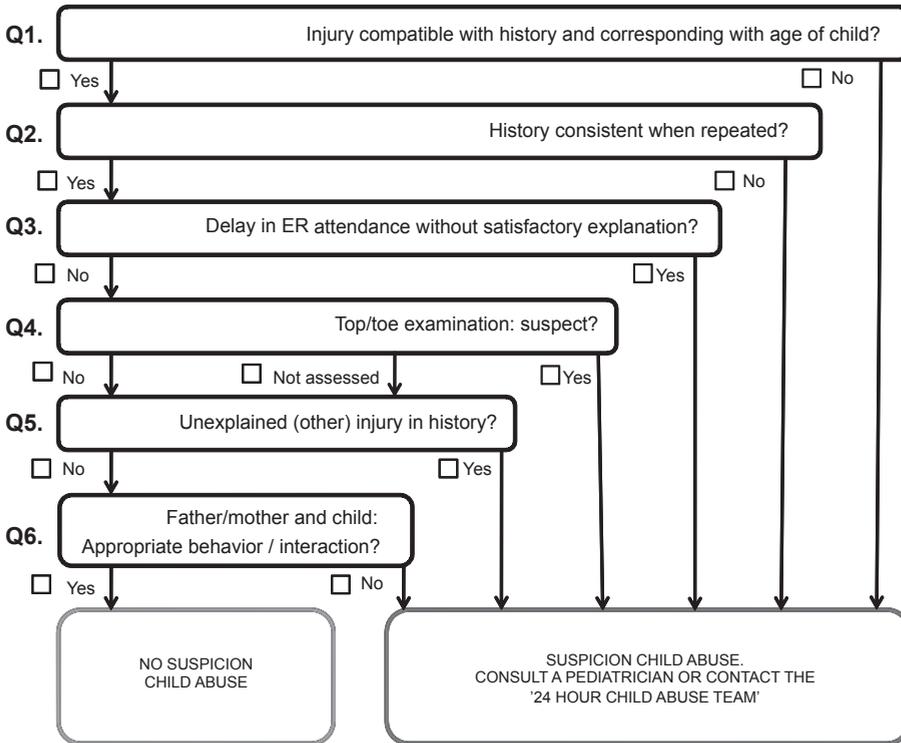


Figure 1. SPUTOVAMO-R

questions with binary answer possibilities pointing unambiguously at the suspicion of child abuse or not. This SPUTOVAMO-R (see figure 1) is quite similar to the detection instrument of Benger et al. (8).

The recently published meta-analysis by Woodman et al. (5) showed that there was clear evidence that physically abused children attending ER's are missed, although estimates ranged substantially (11-64%). However, the validity and applicability of the three included studies was poor. All three studies met only 2 of the 12 quality criteria listed in the Quality Assessment of Diagnostic Accuracy Studies (QUADAS) tool, an evidence based quality assessment tool for systematic reviews of diagnostic accuracy studies (17).

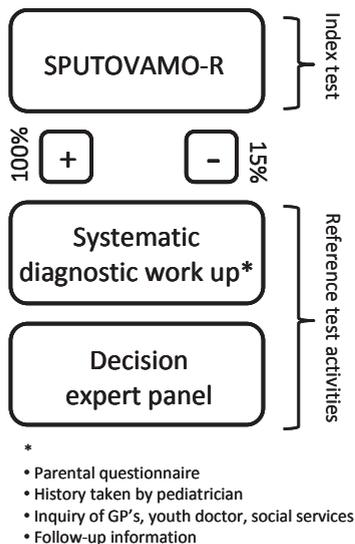
The conclusion of Woodman et al. (5) is in line with the conclusion of another recently published systematic review of Louwers et al. (18). Both reviews stated the conclusion that well-designed, large-scale studies are required to validly evaluate the accuracy and effectiveness of assessments that are currently used in ER's for identifying abused children and for initiating appropriate interventions (5;18).

The study 'Child Abuse Inventory at Emergency Rooms' (CHAIN-ER) is designed to provide data in children presenting with physical injury at ER's on the predictive value of SPUTOVAMO-R in establishing a diagnosis of child abuse.

## METHODS/DESIGN

### Study design

A cross-sectional multi-center study with 6 months follow-up will be conducted to assess if active structured inquiry by ER staff, using the SPUTOVAMO-R, can accurately detect physical maltreatment in children presenting at ER's with physical injury. The diagnostic value of SPUTOVAMO-R (index test) is to be tested against the consented opinion of an expert panel (reference test) (see figure 2).



**Figure 2.** Design of CHAIN-ER

### Study population

The study population will include 5,000 children aged 0-7 years, referred as from June 2009 to an ER because of any physical injury. Four hospitals, of which one academic and three

non-academic hospitals in the region of Utrecht, a city in the center of the Netherlands, will participate. Children injured due to witnessed traffic accidents and children who were dead at ER arrival, will be excluded. All participating ER's combine adult and pediatric care. The annual childhood (0-18 year) attendance rate of the 4 ER's varies between 4000 and 8200 visits per year. In all participating hospitals SPUTOVAMO-R is filled out for all patients under the age of 18 years attending the ER. This is a compulsory field in the electronic file of the medical records of patients under the age of 18 years.

### **Procedure**

In the standard clinical care, the first step in the process of recognition of child abuse is completing the SPUTOVAMO-R by ER professionals during the ER visit. SPUTOVAMO-R is to be considered positive for the suspicion of physical child abuse when at least one of the six questions is deviant. The result of this first step will predominantly determine the consecutive clinical work-up for the potentially maltreated child. A suspicion of child abuse by the ER professional (positively screened SPUTOVAMO-R) is followed by a systematic workup for possible child abuse starting with a pediatric consultation in the ER. After the work-up, all screened positive cases are discussed in the multidisciplinary Child Abuse Team in the presence of the Child Protection Services.

The research procedure for the study subjects runs parallel to the clinical work up and is as follows. All SPUTOVAMO-R positives and a random sample of the SPUTOVAMO-R negatives will undergo the same systematic diagnostic work up. For the expert panel it is unfeasible to perform such an extensive reference test in all 5,000 cases and therefore a random sample of 15% of the negative SPUTOVAMO-R cases will be taken. Before the start of the study, all ER personnel will be adequately trained (19) in objectively recognizing child abuse and in filling in the SPUTOVAMO-R form.

The diagnostic work up for this study will be supplementary to the essential clinical care and consists of several extra steps. First, pediatricians will clarify the initial injury for all study subjects. In order to be sure that the expert panel will have access to all necessary information to judge the SPUTOVAMO-R results, pediatricians will phone all included families to ask any additional questions related to the injury, which are not apparently asked or documented in the ER report. Second, identification of child abuse risk factors will be assessed by parental, general practitioners' and youth health care giver's questionnaires. These risk factors will include factors regarding the child, its parents and its family. Third, additional information about the event under study, as well as information about potential later ER visits, during a 6 months follow up period will be obtained.

All information acquired will be presented in a highly structured way to the members of the expert panel for each included case subjected to the reference test. A single reference test for the ultimate diagnosis of child abuse is obviously lacking. In CHAIN-ER the *true* presence or absence of child abuse for all the subjects under study will be determined using a consensus procedure of an expert panel consisting of three (forensic) pediatricians. All panel members are extensively trained in recognizing child abuse and work as experts in the field. The expert panel will have all subject information of the entire work up at its disposal. Well-informed and blinded to opinions of previous health care providers about individual cases, the panel will decide firstly on the nature of the injury (intentional or non-intentional), secondly on the probability that this child is victim of child abuse in a broad sense (i.e. the four types of child abuse) and thirdly on the need for help from social services in this family. Consensus is achieved when all panel members unanimously decide on the intentional or accidental nature of the injury. For the decisions about the probability of child abuse in general and the need for help from social services consensus is determined by the majority of the three expert opinions.

### **Ethical approval**

This study has been reviewed and approved by the Medical Ethical Committee of the University Medical Center Utrecht (reference 08-378). At ER presentation, written information on the current research will be provided to all parents. Since we expect parents of SPUTOVAMO-R negatives to participate more easily than parents of SPUTOVAMO-R positives (so called response bias), we were willing to make the threshold of participating as low as possible for all parents. We expect that the threshold to participate will be lower when parents only have to give their oral agreement. Especially for the conduct of the CHAIN-ER project, we received permission of the Ministry of Justice (Privacy Helpdesk) that oral informed consent for the exchange of information with other health care professionals will suffice instead of the customary written informed consent. This agreement was stated in a covenant signed by all representative organizations of the participating health care professionals. The Medical Ethical Committee of the University Medical Centre Utrecht approved this agreement as well.

### **Statistical Analyses and Power Calculation**

The study population will include approximately 5,000 children, of which we expect approximately 100 cases to be positive (2%). Of all SPUTOVAMO-R negatives a random sample of 15% will be taken. This will give the expert panel a workload of approximately

750 cases (650 SPUTOVAMO-R negatives and 100 SPUTOVAMO-R positives). A potential disadvantage of taking a random sample is that false negative cases can not be accurately determined when the prevalence of child abuse in cases with negative test results is very small. However, even when the prevalence of false negative test results is only 1%, a random sample of 15% will detect several (i.e. approximately 8) false negative cases.

To make it possible to determine both positive and negative predictive value (PPV and NPV) as well as the test's sensitivity and specificity of SPUTOVAMO-R, we need the panel to receive both positive and negative SPUTOVAMO-R cases. To calculate the PPV, the sampling fraction of the test negatives must be known (20), which we know in this case (1/0.15). Additional techniques that will be used to determine the value of SPUTOVAMO-R are tests of discrimination with calculation of Areas under Receiver Operating Characteristic curves, and calibration techniques to evaluate if predicted abuse corresponds to observed abuse.

To determine associations between potential child abuse risk factors and true child abuse, logistic regression is used with the opinion of the expert panel (child abuse yes/no) as dependent variable and the several risk factors as measured by questionnaires as independent variables. We expect about 100 cases (i.e. child abuse confirmed by the reference panel). For every 10 confirmed cases we could examine 1 independent variable (according to the 1:10 rule of Harrell (21)). With approximately 100 confirmed child abuse cases, we will have the opportunity to determine 10 variables. If we would determine the associations between more than 10 potential child abuse risk factors and true child abuse, we will need to reduce the number of predictors by cluster analysis. The (restricted) set of predictors will be used in the univariable logistic regression analysis. Relevant factors will be used in a multivariable logistic regression model.

## **DISCUSSION**

To the best of our knowledge, CHAIN-ER will be the first study to determine both positive and negative predictive value of a child abuse detection instrument used in the ER by performing the index test and subsequently the same reference method for all study subjects. This allows us to determine both PPV and NPV of the index test under study, as well as its sensitivity and specificity. Most existing evidence on diagnostic tests for child abuse at ER's is flawed because those detected as negative are not subjected to the same reference standard as the positive detected cases.

Furthermore, we think a main advantage of the use of an expert panel is that, contrary to members of a multidisciplinary team (commonly the reference test in clinical practice), the members of the expert panel are not involved in case management of the included patients and might feel loyalty or disloyalty to the patient and its caregivers. Another advantage is that panel members, again contrary to members of a multidisciplinary team, are blinded for the result of SPUTOVAMO-R (the index test of main interest) which avoids so-called incorporation bias that could result from the test under study being incorporated in the assessment of the final diagnosis (22).

A third strength of this study is the large number of included patients. The SPUTOVAMO-R results of approximately 750 cases which are to be tested against the opinion of the reference panel will reflect a study population of approximately 5,000 children (see statistical analysis). These 5,000 children will come from both academic and non-academic hospitals. Both citizens from the city center and from rural areas will visit these hospitals, which seems to make the study population a correct reflection of the general Dutch childhood population.

However, conducting a study on diagnostic accuracy of a child abuse detection instrument is accompanied by several scientific hurdles, such as the lack of an accepted reference standard. In CHAIN-ER we will try to optimize the gold standard test by the use of the aforementioned expert panel.

In addition, differential (non-) response is a potential scientific hurdle as well. To obtain and to use medical information of the infant, informed consent of its parents is needed. It may well be that parents who maltreat their children refuse to participate. On the other hand, one may reason that in case of true child abuse, parents might in fact agree to participate in research, to avoid any suspicion of maltreatment. Nevertheless, in both ways, a certain level of differential (non-) response is inevitable. CHAIN-ER will aim to quantify the differential (non-) response concern, by checking afterwards whether a certain level of differential (non-) response may be present in the data. When parents do not want us to obtain additional information from other health care professionals, the yet available information of the ER visit, including medical history, physical examination and potential supplemental diagnostic investigations, such as the multidisciplinary team assessment are still available. Accordingly, one (e.g. an expert panel) can judge afterwards the (incomplete) case on the yet available information of the ER visit. Although such judgment will obviously be based on less information than in other subjects, investigators may still be able to decide on the (non) inflicted origin of the injury. Based on the thus obtained 'endpoints or panel decisions' investigators can determine whether there is a difference between the refusers and the non-refusers in terms of all available or observed child and injury characteristics.

Accordingly, the potential of non-differential response can be as good as possible addressed by the data, and -if present- its influence on the observed accuracy of the diagnostic index tests discussed.

In conclusion, notwithstanding the scientific challenges of conducting a diagnostic accuracy study on a child abuse detection instrument, CHAIN-ER will provide accurate data on the predictive value of SPUTOVAMO-R.

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## CHAPTER 5

# **Child abuse: the value of systematic screening at Emergency Rooms**

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*Under review*

## **ABSTRACT**

### **Background**

There is no conclusive evidence that diagnostic tools detect physical child abuse among children coming to emergency rooms (ERs), but this evidence is urgently needed because both false-positive and false-negative diagnoses have serious adverse effects. The aim of our study 'Child Abuse Inventory at Emergency Rooms' (CHAIN-ER) was to establish whether a widely used checklist to detect abuse accurately detects or excludes physical abuse among children presenting to ERs with physical injury.

### **Methods and findings**

CHAIN-ER is a large multicentre study with a 6-months follow-up that included 4290 children aged 0-7 years attending the ER because of physical injury. All children were systematically tested with the index test. A national expert panel (reference standard) retrospectively assessed all checklist positive cases and a 15% random sample (for efficiency reasons) of the checklist negative cases for physical abuse, using additional information, namely, an injury history taken by a paediatrician, information provided by the general practitioner, youth doctor and social services by structured questionnaires, and 6-month follow-up information.

4253/4290 (99%) children agreed to follow up. At a prevalence of 0.07% (3/4253) for inflicted injury by expert panel decision, the positive predictive value of the checklist was 0.03 (95% CI 0.006-0.085), negative predictive value 1.0 (0.994-1.0), false positive predictive value 0.97 (0.02-0.99) and false negative predictive value 0.0 (0.0-0.006). There was 100% (93-100) agreement about inflicted injury in checklist positives between the expert panel and child abuse experts.

### **Conclusions**

Rare cases of inflicted injury among pre-school children presenting at ERs for injury can all be captured by an easy-to-use checklist but at very high false positive rates. Subsequent assessment by child abuse experts can be safely restricted to checklist positives without missing any cases of inflicted injury.

## **INTRODUCTION**

Physical abuse is assumed to cause 1% of injuries seen in children attending the emergency room (ER).(1) Both direct consequences of injury, and adverse effects on education, mental and physical health, and violent or criminal behaviour(2, 3) justify proper diagnosis at hospital ERs. However, physical child abuse seems underreported by professionals, mainly due to non-recognition.(4) Indeed, estimated proportions of missed cases range from 11% to 64%.(1, 2, 4, 5)

Standard diagnostic instruments in minor attendees are increasingly being used in ERs worldwide to detect child abuse.(6-14) Typically, such instruments register age, type of injury, repeated admission, and consistency of medical history and injury.(2, 4) In the Netherlands, from 1996 onwards, the SPUTOVAMO checklist was increasingly used in ERs to detect physical abuse among children attending with physical injury.(9) As from 2007, when the Dutch Health Care Inspectorate formulated mandatory ER detection requirements, all hospital ERs use SPUTOVAMO as standard detection checklist in all minor attendees.(15) Local versions were developed(14) with other items in the checklist such as evaluation of interactive behaviour of child and caregivers to suit the checklist for detection of other types of abuse. Nationwide use of SPUTOVAMO did strongly increase the numbers of potential child abuse.(15)

An urgent problem with the use of diagnostic tools for physical child abuse, including SPUTOVAMO, is that comprehensive evidence on their accuracy is lacking.(2, 5) There are general recommendations, such as from the American Academy of Pediatrics, to optimize paediatricians' skills and examinations,(11) but the basis for additional use of checklists is currently not supported by evidence.(16) This lack of evidence seems largely due to inherent difficulties in designing such diagnostic studies, such as the need for reference testing in checklist-negatives, blinded evaluation of tests, and medical ethical and legal issues.

The Child Abuse Inventory at Emergency Rooms (CHAIN-ER) study aimed to assess among children presenting with physical injury at Dutch ERs, the diagnostic accuracy of this nationally implemented SPUTOVAMO checklist for physical abuse as primary outcome, and for neglect and need for help from social services as secondary outcome. Secondly, CHAIN-ER assessed if consulting of a 'child abuse paediatrician' (CAP) is a safe and efficient strategy if this consultation is limited to screen positives. Finally, as an overall check on the actual value of a positive checklist result, child abuse reports were assessed for all study participants using life-time registry data from the national Child Protection Services for up to 4 years after the initial ER visit.

CHAIN-ER aimed to comply with diagnostic study quality criteria (QUADAS),(17) and results are here reported by STARD criteria.(18)

## METHODS

### Participants

All children aged 0-7 years admitted to an ER between June 2009 and December 2010 for any physical injury were included. One academic and three non-academic hospitals in the region of Utrecht, a city in the centre of the Netherlands, participated. Evident victims of physical child abuse (admitted by perpetrator at presentation), victims of (witnessed) traffic accidents and children who had died before arrival were excluded. We restricted to young children, for whom self-disclosure is unlikely(11) and for whom ERs are among

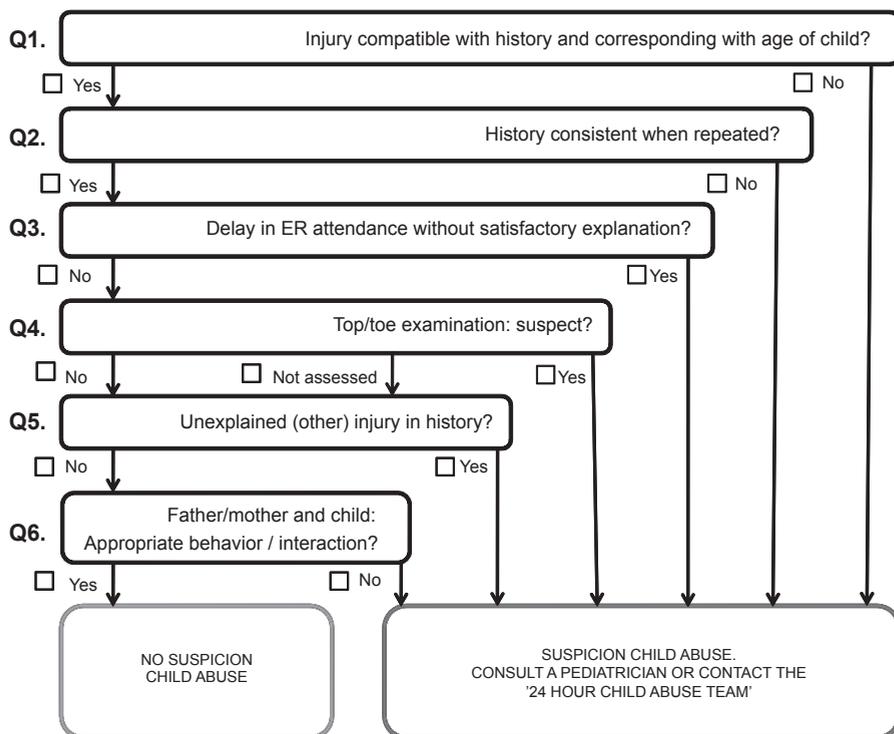


Figure 1. SPUTOVAMO-R (index test)

the few places where abuse can be detected since school attendance is not yet obliged.

The following characteristics of participants were registered: age; sex; ethnic origins categorized as North European and non-North European, by the surname of the child; socio-economic status (low/other), as defined by residing in risk areas through classifications of national zip-codes from the Dutch governmental 'Netherlands Institute for Social Research' (<http://www.scp.nl/english/>), based on average income, employment and educational level; previous ER visits in same hospital; time of present visit; type of present injury; mechanism of injury; injury severity.

### **Checklist**

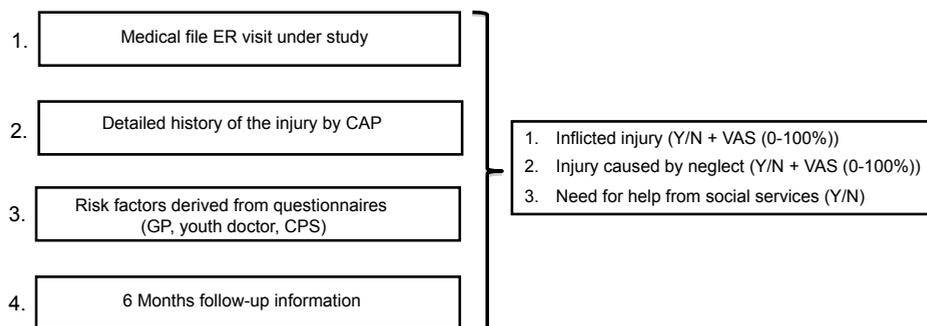
All included patients were screened by the SPUTOVAMO-R checklist (index test), the revised version of the original,(9) with 6 questions with yes/no answer options, (figure 1) further referred to as the checklist. The checklist classifies positive for suspected child abuse if at least 1 question scores abnormal. The complete checklist was a compulsory field in the electronic files of the medical records of all attendees.

### **Outcome definition**

The primary outcome was injury due to physical abuse by a parent or other caregiver, defined as 'use of physical force or implements against the child that has resulted in physical injury'.(19) Injury caused by neglect and need for help from social services were secondary outcomes. We evaluated neglect as 'failure to meet a child's basic physical needs or failure to ensure a child's safety'.(19) We defined need for help from social services as any concern about the situation of the child that requires consultation of social services. Need for help thus potentially included the cases of injury due to physical abuse and injury caused by neglect.

### **Reference standard procedure**

The reference standard procedure was carried out in all checklist positives and a computer-generated random sample of 15% of checklist negatives in addition to the required clinical care according to (inter)national guidelines.(11, 20) In the absence of objective reference tests as with child abuse, diagnostic research guidelines advise consensus diagnosis by expert panels.(21-24) The checklist was tested against the majority opinion of a 3 member's expert panel of cumulative 6-month diagnostic information presented in a structured anonymous paper file format for independent assessment by each panel member. Diagnostic information was provided by the following consecutive steps (figure 2).



**Figure 2.** Different steps of the diagnostic outcome assessment by consensus of the expert panel (reference standard)

1. All clinical information about the ER visit, including available radiological images. Radiological images were evaluated by a child-radiologist (RAJN) specialized in skeletal imaging of suspected intentional physical injuries, blinded to the checklist outcome.
2. Detailed report of additional semi-structured history taking regarding the injury by experienced CAPs (EMP, EP) based on telephone interviews of parents/caregivers shortly after the ER visit and on full access to medical records, including the checklist outcome. These CAPs scored physical child abuse and child neglect by the same definitions as used by the expert panel (see below).
3. Information from healthcare professionals about risk factors for child abuse. Research nurses (LN, LP, LS, NH, SD) requested general practitioners (GPs) and youth doctors of all positive screened and the 15% sample of the negative screened children to fill out a structured questionnaire on child, parental and environmental risk factors of child abuse. Nurses checked for registrations at the Child Protection Services, a national council under the Dutch Ministry of Safety and Justice. Nurses were aware of the checklist outcome.
4. After 6 months, nurses checked the electronic patient file for additional clinically relevant information, including later ER visits, and summarized this in the expert panel paper file.

### Expert panel

Prior to and during the reference standard procedure, definitions of the outcome measures were clarified in joined sessions to 3 paediatrician panel members (AB, EAL, IMBR), each nationally acknowledged clinical experts with forensic experience on child

abuse. Throughout this reference standard procedure, panel experts were kept blinded to the checklist result (22) by deleting that information from steps 2 and 3.

Members independently assessed whether the injury was inflicted (yes/no), and what they thought was the likelihood of the inflicted injury using a continuous visual analogue scale (VAS) of 0-100%. For this analysis we defined a positive case of inflicted injury when the likelihood was >50%. They also judged whether the injury was the result of neglect (yes/no) and the likelihood of neglect as cause of the injury, again using a continuous VAS of 0-100% (defined positive at >50%) and whether there was a need for help from social services in this family (yes/no).

For all outcomes, a case was considered positive by majority decision.

### **Life-time Child Protection Services child abuse reports**

Additional to reference testing, for all included children any reporting of abuse to the Dutch Child Protection Services was collected over life-time up to approximately 4-years following the ER visit. Data were collected in January and February 2014 and merged with the CHAIN-ER data on an aggregate, non-identifiable basis, by positive or negative checklist outcome.

### **Informed consent**

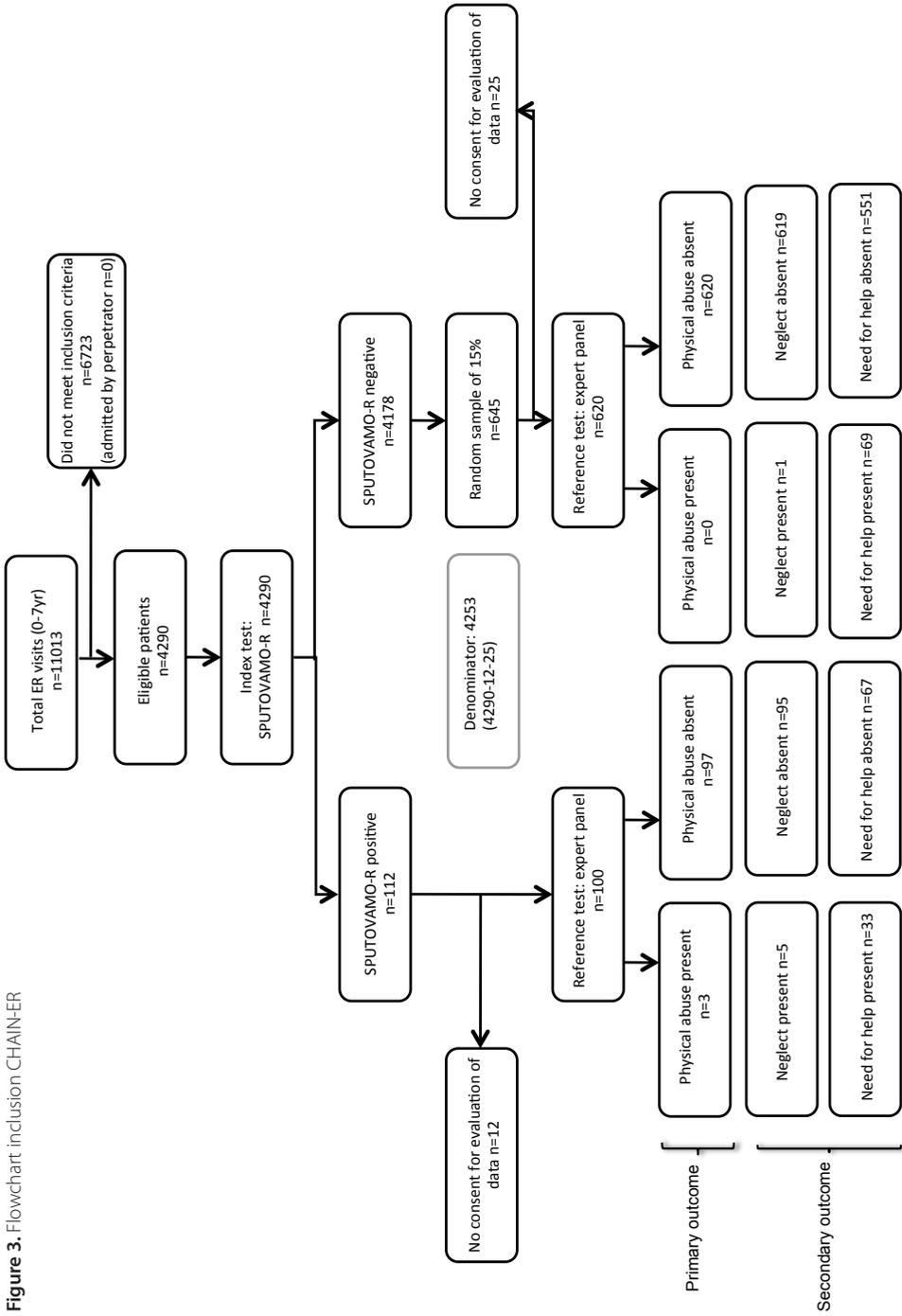
CHAIN-ER was approved by the Medical Ethics Committee of the University Medical Center Utrecht. Specific permission was granted to take oral informed consent only. Written information was given during the ER visit. Further information about CHAIN-ER was given, and informed consent requested, by a specially trained research nurse in a telephone call to parents shortly after the ER visit. A translator was available at request. Informed consent was separately asked for 3 study steps: extra history taking by the CAP; contacting the GP, youth doctor and Child Protection Services for information about risk factors; and anonymous processing and evaluation of obtained data. Children with parents refusing anonymous processing and evaluation of data were excluded from the study.

### **Statistical analysis**

Participants' general characteristics were described as means or proportions with corresponding dispersion measures.

For our primary objective to establish the diagnostic accuracy of the checklist, checklist results were evaluated against majority expert panel diagnoses for each outcome, with

Figure 3. Flowchart inclusion CHAIN-ER



calculation of predictive values (PVs) and sensitivity and specificity with 95% exact binomial confidence intervals.

For our secondary objective, to assess the value of having CAPs assessing checklist screen positives, we assessed the agreement between the physical abuse diagnoses by CAPs and the expert panel.

Finally, life-time child abuse reports to the Child Protection Services were assessed for all CHAIN-ER participants for up to January 2014, and aggregated by the ER checklist outcome categories. A risk ratio for being reported at the Child Protection Services with a positive checklist result as compared to a negative checklist result, was calculated with an approximate 95% confidence interval.

Inter-rater agreement between each of the panel members was assessed by two-way intra-class correlation coefficient (ICC). ICC were classified according to arbitrary cut-off values as poor (<0.20), fair (0.21–0.40), moderate (0.41–0.60), good (0.61–0.80) or very good (0.81–1.00) agreement.

Analyses were performed using PASW statistics 20.0 and STATA/SE 11.0.

## **RESULTS**

4290 Children were eligible for inclusion (see figure 3). Of these, 112 (2.6%) had a positive checklist. With the 15% random sample (n=645) of children with a negative checklist, parents of a total of 757 children were asked to participate in the reference standard procedure.

Parents of 12 (10.7%) checklist positive children and of 25 (3.9%) checklist negative children refused permission for data processing. Of these 37 children, we found one child to have possibly inflicted injury as clinical outcome. The remaining study sample thus included 720 children. Of these, the CAP could not interview the parents of 192 children about the injury (step 2), because of refusal (n=32) or repeatedly being unreachable (n=160), leaving 528/720 participants being evaluated by the CAP. Of these 720 children, 35 parents did not give permission for researchers to contact other healthcare professionals (step 3). The baseline characteristics of the 720 included children are shown in the appendix (table S1). We only could assess the clinical outcome for these children and found one patient to have possibly inflicted injury.

Based on the reference standard procedure information, the injury was considered inflicted in 3 out of 4253 children, an overall prevalence of 0.07% (95% CI 0.01 – 0.2).

Injuries were considered caused by neglect in six children with an overall prevalence of 0.3%  $((5 + (1 \cdot 4153/620))/4253)$ . Help from social services was considered needed in 102 children, with a prevalence of 11.6%  $((33 + (69 \cdot 4153/620))/4253)$ .

**Table 1.** Value of child abuse checklist for diagnosis of inflicted injury, injury due to neglect and need for help from social services in children admitted with physical injury at ER.

Index test		Expert panel								
		Inflicted injury			Injury due to neglect			Need for help		
		Yes	No	Total	Yes	No	Total	Yes	No	Total
Checklist	Positive	3	97	100	5	95	100	33	67	100
	Negative	0	620	620	1	619	620	69	551	620
	Total	3	717	720	6	714	720	102	618	720
	PPV	0.030 (0.006-0.085)			0.050 (0.116-0.113)			0.330 (0.239-0.431)		
	NPV	1.000 (0.994-1.000)			0.998 (0.991-1.000)			0.889 (0.861-0.912)		
	Sens	1.000 (0.292-1.000)			0.833 (0.359-0.996)			0.326 (0.234-0.423)		
	Spec	0.865 (0.837-0.889)			0.867 (0.840-0.891)			0.892 (0.864-0.915)		

PPV = positive predictive value; NPV = negative predictive value; Sens = sensitivity; Spec = specificity

Table 1 shows the diagnostic value of the checklist for inflicted injury by panel decision on all study outcomes. The positive PV was 0.03 at a false positive rate of 0.97 (95% CI 0.915 to 0.994) and zero false negatives (0.0, 95% CI 0.0 to 0.006). All three children considered by the expert panel to have non-accidental injuries had tested positive on the checklist. Details of the three cases of inflicted injury are given in the appendix. Similar results were found for the outcome injury caused by neglect. Higher positive PVs were found for need for help from social services but lower negative PVs.

Of all 49 checklist positives seen by CAPs, there was 100% (95% CI 93-100) agreement between the CAPs' diagnosis and the expert panel diagnosis.

Table 2 shows the numbers of children that had tested checklist positive and negative, and their respective reports to the Child Protection Services up to January 2014. In all 4253 included children, there were a total of 70 reports for physical child abuse to the Child Protection Services, 7 in checklist positive and 63 in checklist negatives (risk ratio 4.61, 95% CI 2.14 to 9.95). For general child abuse there were 203 reports, 15 in 100 checklist positives and 188 in 4153 checklist negatives (risk ratio 3.31, 95% CI 2.03 to 5.39). 'Life-time risks' for CPS reported physical child abuse and CPS reported general child abuse in this sample were 1.6% (70/4253) and 4.8% (203/4253) respectively.

Panel inter-rater agreement for inflicted injury was 0.82 (95% CI 0.80 to 0.84), for injury caused by neglect 0.07 (95% CI 0.02 to 0.11), and for need for help from social services 0.40 (95% CI 0.35 to 0.44).

**Table 2.** Life-time number of Child Protection Services physical abuse reports up to 4 years after last inclusion

		Child Protection Services Reports	
		Physical child abuse	
		Yes	Total
Checklist	Positive	7	100
	Negative	63	4153
	Total	70	4253

## DISCUSSION

Based on good agreement between expert panel members, only 0.07% of children aged 0-7 years presenting with injury at the ER had been physically abused. The easy-to-use child abuse detection checklist, which is routinely used in Dutch ERs, correctly classified all true negative cases of physical abuse by expert panel decision. In addition, there was full agreement about inflicted injury in checklist positives between the expert panel and CAPs.

### Strengths and limitations

A strong feature of our diagnostic study, involving 4253 children aged 0-7 years, is that it is the first that meets all QUADAS criteria for diagnostic accuracy studies, whereas former diagnostic studies met only a minority of all 14 criteria.(2, 14) To date, no diagnostic studies of child abuse have used the same reference standard procedure for children that tested positive and negative with checklist. Consequently, accurate predictive values of a negative outcome of a checklist to detect child abuse were not available before.

Some issues need further consideration. Misclassification of the outcome might explain the low prevalence of inflicted injury. However, we used a narrow definition of inflicted injury and we concur with methodological guidelines indicating that the majority opinion of a panel of experts is the best possible reference standard. Our panel members are regarded as national experts in the field of child abuse. As they were not the treating physicians, feelings of (dis)loyalty towards patients and caregivers cannot have biased

our findings. Moreover, they assessed the information mutually independently, thereby avoiding influence of opinions and group thinking processes.(25) Panel members were blinded to the results of the checklist, which avoided so-called incorporation bias.(22) Lastly, the patient files presented to panel members contained all relevant information, including X-ray imaging evaluated by an expert radiologist blinded to checklist results, and information about risk factors obtained from other healthcare professionals.

Participation bias is not likely an explanation for the low prevalence of physical abuse. The parents of 37 of the 757 patients (4.9%) refused to participate in the reference standard procedure. Although the expert panel could not make a final diagnosis for the children of these parents, we assessed the clinical outcome for these patients and found only one patient to have possibly inflicted injury, which would not materially influence the low prevalence of physical abuse.

The 0.07% prevalence of true physical abuse in our study is much lower than the 1% prevalence reported by Woodman et al.(2) Differences in study design may explain the differences in prevalence estimates of physical abuse at ER attendees. The previous estimate of 1%(2) was based on a systematic review of four studies,(7, 12, 26, 27) with prevalence ranging from 0.37% to 1.38%. In these studies, child abuse was identified on the basis of referral to social services,(12, 26) disclosure by the child or caretaker,(27) or E-codes and ICD codes.(7) This less rigorous outcome definition may explain higher prevalence. The life-time Child Protection Services physical abuse reports found in our study up to 4 years after last inclusion was 1.6% (70/4253). Pless et al.(12) studied children that screened positive at the ER to examine if the Suspected Child Abuse and Neglect (SCAN) sheet, comparable to our checklist, could detect abused children and found a positive PV of 0.69 for 'referral to social services' after extensive evaluation by medical staff – not blinded for checklist results - as the reference standard. The difference in outcome, 'referral to social service' versus 'inflicted injury' and the difference in the method used to establish the diagnosis, 'extensive evaluation by medical staff' versus 'majority opinion of an blinded expert panel', may both explain the large difference in prevalence and positive PV between that study(12) and ours.

Our finding of not being able to unequivocally diagnose injury due to neglect, renders prediction of this kind of injury with a checklist such as SPUTOVAMO-R irrelevant in young children. Notwithstanding the importance of paying attention to the needs of children in general, we consider it questionable whether *systematic screening* for injury caused by neglect and need for help should be part of ER professionals' instrumentarium.

Our life-time check with the national Child Protection Services did indicate that a positive checklist was associated with an more than 3 fold increased chance of reporting for general child abuse and an almost 5 fold increased chance of reporting for physical abuse. Clearly, a positive checklist does relate to children's general lack of safety, specifically physical abuse. Importantly, 4-5% of checklist negatives were ever reported, very similar to a background risk of 4-78% reported elsewhere.(1) In view of the fact that general reporting to Child Protection Services is not the same as a momentary diagnosis at the ER, there is thus very little indication that a negative checklist outcome is false. A child with a positive checklist result, however, should always be checked at Child Protection Services to include life-time safety in the final diagnosis or rejection of child abuse.

### **Clinical implications and Conclusions**

We advise to apply a simple checklist like SPUTOVAMO-R for every child with injuries presented at ERs to ensure detection of inflicted injuries followed by a work-up for the positively screened children by a CAP.

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## APPENDICES

**Table S1.** Characteristics of patients based on outcome defined by the expert panel

	Non-accidental injuries		Accidental injuries
	Inflicted n=3	Neglect n=6	n=711
Age in years, mean (SD)	1.03 (0.8)	2.1 (1.3)	3.8 (1.8)
Age ≤ 1 year	1 (33.3)	1 (16.7)	41 (5.5)
Sex, male (%)	2 (66.7)	6 (100)	409 (57.5)
Ethnicity (%)			
North European	2 (66.7)	3 (50.0)	493 (69.3)
Non-North European	1 (33.3)	3 (50.0)	218 (30.7)
SES (%)			
Low	0 (0)	3 (50.0)	167 (23.5)
Other	3 (100)	3 (50.0)	544 (76.5)
Number of previous ER visits in same hospital (%)			
0	3 (100)	4 (66.7)	520 (73.1)
1-2	0 (0)	2 (33.3)	152 (21.4)
>2	0 (0)	0 (0)	39 (5.5)
Time of ER visit (%)			
Day (8:00 am-6:00 pm)	2 (66.7)	4 (66.7)	451 (63.4)
Evening (6:00 pm-10:00 pm)	0 (0)	2 (33.3)	229 (32.2)
Night (10:00 pm-8:00 am)	1 (33.3)	0 (0)	31 (4.4)
Monday-Friday	1 (33.3)	4 (66.7)	491 (69.1)
Weekend	2 (66.7)	2 (33.3)	220 (30.9)
Type of injury (%)			
Closed head	1 (33.3)	1 (16.7)	57 (8.0)
Bone	1 (33.3)	2 (33.3)	217 (30.5)
Soft tissue	1 (33.3)	2 (33.3)	421 (59.2)
Burns	0 (0)	1 (16.7)	16 (2.3)
Mechanism (%)			
Fall of same height	1 (33.3)	0 (0)	196 (27.6)
Fall of height <3m	0 (0)	3 (50.0)	248 (34.9)
Fall of height >3m	0 (0)	0 (0)	7 (1.0)
Bicycle injury	0 (0)	0 (0)	58 (8.2)
Fire	0 (0)	1 (16.7)	13 (1.8)
Cutting	0 (0)	0 (0)	13 (1.8)
Injury by object	0 (0)	0 (0)	81 (11.4)
Animal bite	0 (0)	1 (16.7)	2 (0.3)
Pull	0 (0)	0 (0)	33 (4.6)
Others	2 (66.7)	1 (16.7)	60 (8.4)
Severity (%)			
Homewards without outpatient appointment	0 (0)	0 (0)	384 (54.0)
Homewards with outpatient appointment	1 (33.3)	2 (33.3)	256 (36.0)
Hospitalization	2 (66.7)	4 (66.7)	71 (10.0)

## **Cases**

- A boy (1.5 years) and both parents visited the ER for an injury on the boy's left leg. The parents told that the boy had fallen over his toys while playing. Physical examination revealed a large haematoma on the boy's left leg. X-ray examination revealed a fracture of the left femur shaft. The child abuse checklist was positive because the history was not compatible with the injury (question 1).
- A girl (1.3 years) and her mother visited the ER. The mother said that the biological father had kicked and beaten the girl during the weekly visit a few hours earlier that day. On physical examination, the paediatrician found three erythematous areas on the back, which were compatible with firm exertion possibly as a result of pressure from tightly holding the child. The history and information from the Child Protection Services revealed several risk factors, such as violent behaviour of the father towards both the mother and the child in the past. Although the presenting problem was 'injury due to physical abuse', the child was routinely tested with the child abuse checklist and considered positive because of inadequate behaviour of parents (question 6).
- A boy (1 month) and both parents attended the ER for an apparent life-threatening event. He had stopped breathing for about 20 seconds, had started to gasp, and then had become cyanotic and less responsive. Neurological examination revealed a lethargic baby with macrocephaly, disturbed eye movements, and disturbed movement pattern. The anterior fontanel was full and downward gaze was noticed intermittently. Magnetic resonance imaging of the brain showed multiple subdural hygromas, cerebral infarctions, and a fracture of the parietal bone. The boy tested positive because the history was not compatible with the established injuries.



## CHAPTER 6

# General discussion

## GENERAL DISCUSSION

In this thesis studies were conducted on child abuse, with a focus on physical abuse. Its cornerstone is the CHAIN-ER (Child Abuse Inventory at Emergency Rooms) study, a large-scale prospective diagnostic study to evaluate the SPUTOVAMO-R as a diagnostic instrument for inflicted injury.

### Diagnosis versus screening

Although arguably, we considered the studies in this thesis as diagnostic studies rather than screening studies, but they clearly contain elements of both diagnostic and screening research. There is a clear difference between diagnosing and screening for a disease (see table 1). Diagnosing is the determination of a disease or condition that causing a person's signs and symptoms. In daily practice, the diagnostic process starts with a patient with a certain complaint which makes the physician suspicious of him or her having a particular disorder out of a series of possible disorders (differential diagnosis).(1) Screening refers to the application of a medical procedure or test to people who as yet have no symptoms of a particular disease, for the purpose of determining their likelihood of having (an early stage of) that disease. In fact, screening is looking for characteristics or perhaps even risk factors in a person to determine the likelihood of suffering from asymptomatic preliminary stages of a certain disease before symptoms or signs have emerged. Clearly, such characteristics or risk factors are not necessarily the same as diagnostic factors. A risk factor is a determinant that increases the likelihood of disease occurrence; a diagnostic factor is a determinant that helps to set the diagnosis (i.e. likelihood of disease presence). When the screening is positive for the likelihood of the disease or condition one is looking for, a subsequent diagnostic process follows. Already in 1968 Wilson and Jungner(2) stated that for screening several criteria need to be met. The disease that is screened for should be a significant public health problem and a suitable screening test must be available. Moreover, a generally accepted treatment or intervention for the disease should be present. Clearly, a major benefit of detecting a disease at an early stage, when treatment is usually more successful, is reducing the morbidity or mortality from the disease or even preventing the disease expression. However, screening has also some disadvantages like the emotional burden of false-positive test results and the possibility of missing the disease (false-negative test result). In addition, early diagnosis does not always lead to a better outcome. Notably, screening is a form of active care provision to individuals or patients, without them expressing specific requests for it.

**Table 1.** Differences between diagnosing and screening

	<b>Diagnosing</b>	<b>Screening</b>
<b>Domain</b>	Patient with signs and symptoms suspect for outcome condition	Person without signs and symptoms
<b>Determinant</b>	Diagnostic test (based on diagnostic factors)	Screening test (based on characteristics and risk factors' preliminary disease states)
<b>Outcome</b>	Condition present	Likelihood of the condition present (diagnostic process follows in case of positive screening test)

### Diagnosing child abuse versus screening for risk factors for child abuse

In CHAIN-ER we determined the value of SPUTOVAMO-R to establish the diagnosis of inflicted injury due to physical abuse. We did not examine the diagnostic value of the test for other forms of child abuse (see chapter 1). The diagnosis of physical abuse starts with a patient (child) presenting with a certain injury. Setting the (early) diagnosis of inflicted injury is hard if not impossible in an unsuspected general population, i.e. persons without signs or symptoms of 'possible injury' (which would indeed be screened for inflicted injury). In our CHAIN-ER study we primarily diagnosed physical child abuse in suspected children. However, in our reference standard we acknowledge that we also assessed general risk factors for any child abuse (see table 2, B). These risk factors were assessed by youth doctors and general practitioners as part of the a general national screening programme during regular ER visits in any children, regardless whether they presented without or with symptoms or signs of inflicted injury.

**Table 2.** Applicability of different tools for diagnosing and screening for child abuse

	<b>Diagnosing physical abuse</b>	<b>Screening for risk factors for child abuse (all forms)</b>
Individual	A. Diagnostic test	B. Risk assessment
General population	C. Not applicable	D. Risk assessment

Screening, i.e. population screening in unsuspected children, for the medical condition 'child abuse' or 'high risk for child abuse' does meet an important requirement for appropriate screening; child abuse is a serious public health problem with unacceptable levels of morbidity and mortality.<sup>(3)</sup> There cannot be a dispute about the benefits of

timely and accurate detection of child abuse in general. Early detection can prevent further harm in terms of health risk,(4-7) and behavioural and emotional problems.(8) We think that these serious long-term adverse effects of child abuse as a principle warrant any attempt to increase the early detection of child abuse. However, one should also acknowledge that screening for child abuse risks stigmatization in case of false-positive test results.

Here we will provide our considerations about the application of diagnostic and screening procedures for early detection or prevention of child abuse, taking into account the findings of our studies.

### **Diagnosing physical abuse in children with injury**

The results of CHAIN-ER support the use of a simple checklist like SPUTOVAMO-R for every child with injuries presented at an ER to ensure detection of physical abuse followed by a work-up for the positively screened children by a Child Abuse Paediatrician (CAP).

The ER is a logical setting as opposed to, e.g., the general population, to detect physical child abuse for several reasons. Parents visit the ER with their child because of medical concerns and offer the opportunity for the physician to discuss the possibility of physical child abuse. Moreover, the incidence of physical child abuse at the ER is higher than in the general population.(9) Although we showed that indeed diagnosing physical abuse at the ER can be accurately done, several remarks on the detection procedure in the emergency setting must be made, for instance, which children should actually be subjected the diagnostic test, which instrument should be used, and who should apply or conduct that diagnostic test.

In the Netherlands, almost all hospitals use a child abuse detection instrument for all children aged 0-18 year visiting the ER, regardless their reason for visiting. Finkelhor et al(10). showed that adolescents more often do have physical injury due to physical abuse than infants. Therefore, we think it would be meaningful to evaluate the accuracy of a diagnostic instrument, such as SPUTOVAMO-R, also in children above the age of 6 years.

We showed that SPUTOVAMO-R, with its six binary questions, is a valid instrument to detect physical injury in children attending the ER with any physical injury. The question remains whether this instrument could be sufficiently altered into a shorter version to reduce the workload. Since we only found three cases of physical abuse, it was impossible to examine the predictive value of each SPUTOVAMO-R question independently. Further, the SPUTOVAMO-R is a more generic checklist of six questions. It might still be interesting to know whether a single first question such as: 'do you have explicit reasons to suspect

inflicted injury?’ is a useful alternative for the six SPUTOVAMO-R questions. In case of an affirmative answer, further questionnaires or questions may be applied depending on the type of presented physical injury. For example, when the child presents with burns, specific questionnaires such as the burn checklist of et al.(11) could be used for further evaluation. One of the benefits of such a ‘step-wise’ approach is that, in case there is no suspicion, only one question needs to be answered which is less time-consuming but more importantly, less burdening and confronting for parents (certainly in the absence of child abuse).

Finally, we question whether all professionals trained in recognizing child abuse are able to sufficiently diagnose physical child abuse. SPUTOVAMO-R is filled out by ER staff such as nurses or physicians. Ideally, these professionals are trained by educational programmes such as The Next Page(12) as described in chapter 2. The first question of SPUTOVAMO-R, if the injury is compatible with the history, requires specific knowledge on injury mechanisms that is not easy to capture in a general educational programme. To be able to accurately answer this question specific forensic expertise may be needed. Our recommendations from our CHAIN-ER study also included an assessment by an expert paediatrician for every positively tested case. Clearly, not in every hospital such a child abuse expert paediatrician is present. As of December 2014, in the Netherlands, teleconsultation is offered to doctors, combining the expertise of a child abuse paediatrician with that of a (paediatric) forensic doctor. This possibility would prevent unwanted delay in child abuse detection.

## **Screening for child abuse in different levels of care**

### ***General population***

Most health systems throughout the world provide routine care to children aimed at all children. Such systems are platforms for childhood population wide interventions such as vaccination, but also for childhood screening activities such as (early) diagnosis or risk assessments for child abuse.

In the Netherlands, youth doctors do have a special role in the (early) detection or screening for (risk factors of) child abuse. Over 95% of children (0-19) visit the youth doctor on a regular basis.(13) Before the age of 4 years, normally a child has been in touch with the youth doctor approximately 15 times. From 5-19 years there is approximately 5 times a visit in total. Besides these regular visits, youth care professionals speak to staff of day cares and schools on a regular basis as well and discuss children that seem to need extra attention for a reason. A main goal of the youth doctor’s job is to follow the

development of a child. Information about the child and its environment is crucial to evaluate the developmental stage of the child. Shortly after birth and in particular cases even before birth, youth care nurses visit the baby/parent(s) at home and fill in a child abuse risk assessment. Yet, no validated child abuse screening instrument is available, but many different questionnaires are used.(14, 15) The goal of filling in such risk profiles is to make a general risk assessment for any type of child abuse and to offer parents or caregivers the help they need to prevent further harm.

In CHAIN-ER we asked youth care professionals to fill in the child abuse risk assessment (see appendix), and many commented that it had increased their awareness substantially. Although there are many activities aimed at raising general awareness among youth health care and schoolteachers about child abuse, that in itself does not in our view justify population wide application of formal screening (in the general population) for 'child abuse risk' without proper evaluation of its accuracy and possible side-effects. We advocate that wide scale implementation of abuse risk screening instruments, especially if they involve active participation of parents or other caregivers, are studied thoroughly for their accuracy. An appealing aspect of screening for child abuse risk in youth care is that it covers all members of the childhood population. However, that also lays a high burden of proof of cost-effectiveness and care for ethical hurdles with the screening providers.

### **General practitioners**

Many health care systems provide first line care through general practitioners or family doctors. In many systems, these care professionals have a gatekeeper role, also in the Netherlands. Except for emergency situations, people with health complaints first visit their general practitioner. In principle, this care level would be suitable for systematic screening for (high risk of) child abuse. General practitioners are the professionals who mostly do have an overview of all physical, psychiatric or other emotional problems of a patient. In addition, a general practitioner commonly oversees the patient in context of the whole family. The general practitioner may have information about child abuse risk factors present in the child, the parents or caregivers, and in the environment of the child. He/she also has an overview of all health care professionals involved in the care of the child, including possible concerns by other professionals. Therefore, the general practitioner may have an important and crucial role in screening for child abuse. General practitioners could be able to detect risk factors for child abuse at a very early stage. In the Netherlands, when real concerns about child abuse are present, the general practitioner is obliged to take action and consult or report to the CPS, as stated in the Code on reporting child abuse of the Royal Dutch

Medical Association.(16) However, just a few general practitioners consult and report to CPS.

One could argue that general practitioners are professionals that should make a child abuse risk profile of all children under care every once and a while in order to make a proper risk estimation for child abuse, particularly for the types of child abuse with the highest prevalence (neglect and psychological abuse). Systematic risk screening in primary care, however, involving active participation of patients/parents, may well interfere with the general practitioner-patient relationships, which would lay even higher demands on the accuracy and applicability of screening instruments. Also, general practitioners address almost all health problems of all individuals under their care. That does mean that their provisions are demand-based; they do not necessarily meet all patients or their children. One could imagine that abusive families or families at high abuse risk, preferentially avoid general practitioner care, and that for comprehensive catchment of child abuse, implementation of general practitioner screening can only be an adjunctive measure.

### **Emergency Rooms**

Almost all Dutch ERs use (a variant of) SPUTOVAMO-R for *all* children attending the ER specifically aimed at diagnosing inflicted injury. Obviously, other forms of child abuse such as neglect could be captured when screening all children.

A question is whether systematic screening on neglect is part of an ER-professionals' job. Neglect includes omission and several aspects of failure of provision and supervision. Guidelines indicate that many of these features must have a persistent nature for justifiable suspicion of child neglect.(17) For an ER professional it is difficult to determine on basis of a single ER visit whether there is a persistent pattern of failure of provision and/or failure of supervision. Many factors have an effect on diagnosing and referring child neglect, such as professional's perception of neglect,(18) of acceptable behaviour, and of the risk of harm to the child.(18, 19) Nevertheless, ER staff might witness aberrant interactions between parents and children such as emotional unavailability, unresponsiveness and neglect or developmentally inappropriate or inconsistent interactions with the child.(20) These observed interactions should be discussed with parents according to the Code on reporting child abuse and an appropriate diagnostic work-up should be offered. But, alertness for symptoms of neglect and appropriate discussion and referral is not the same as systematic screening for this type of abuse.

To conclude, because of the brief momentary character of ER visits, we think it is unfeasible to screen child neglect at all children visiting the ER, except for children with possible injury related neglect. Systematic application of a screening test for neglect to

all children attending the ER should not be a main activity of ER staff. We believe general practitioners, youth doctors, teachers and other professionals that maintain long-lasting contact with the child will be better able to structurally screen children in order to detect children that are suffering from neglect and/or need help from social services.

### **Different levels of care: different purposes of child abuse detection?**

A fundamental difference between 'screening' activities in various levels of care described above is that in some levels, the predominance of activities will be focused on detection of increased risk for child abuse, while in other levels child abuse will be more among the differential diagnoses. In the general population, screening activities will mainly aim at finding 'high risk children'. In general practice, some signs and symptoms of children may directly infer abuse (differential diagnosis), but most contacts can only relate to high abuse risk detection (risk screening). In emergency posts for general practice and ERs, the very type of acute complaints that underlie emergency room visits, warrant a higher ranking of physical child abuse in the differential diagnosis list than in other levels of care. Thus, when considering uniform screening for abuse it is in our view important to be aware that the (mix of) states to be detected, possible child abuse right now or high risk for child abuse, vary with each level of care. In our view this should play a role in considerations about systematic child abuse detection in various care levels.

Adding to the complexity is that the above might well be different for different forms of child abuse. In the general population and general practice levels, screening might be much more focused on finding (high risk for) neglect rather than less frequent physical abuse. In emergency settings this will on average be the other way around. Thus, a priori risks of various states of child abuse will likely differ between various levels of care. If so, these differing states of screening focus should be reflected in the technicalities and research evaluations of screening.

### **Concluding remarks**

We have attempted to sketch the general conditions for various settings of care to (systematically) detect child abuse. Obviously, the overall purpose is a comprehensive system of both accurate detection of increased risk for abuse and accurate detection of actual cases of abuse. Although we could conceive of other authorities involved in abuse detection, such as judicial authorities, we believe that health care systems have a major responsibility. A close collaboration of various levels of care is in our view the only way to achieve a comprehensive national detection system, a system with the least likelihood of

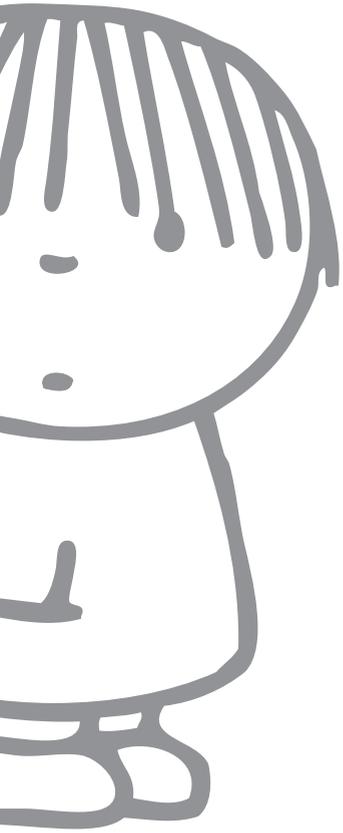
abused children or high abuse risk children 'slipping through'. In this thesis we described the results of CHAIN-ER as an evaluation in just one level of care. We hope that these results will precipitate in ER practice. However, we are convinced that for building a proper comprehensive system of child abuse detection, much more care level-overriding research should be initiated and supported.

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## CHAPTER 7

### **Summary**

## SUMMARY

Child abuse is a significant public health problem with serious consequences, both direct and in the long-term: adverse effects on education, mental and physical health, and violent or criminal behaviour. Early diagnosis, for instance at Emergency Rooms (ERs) may reduce these related adverse effects. (Inter)nationally standard diagnostic instruments are increasingly being used at ERs to detect child abuse. As from 2007, when the Dutch Health Care Inspectorate formulated mandatory ER detection requirements, all Dutch hospital ERs use (a variant of) SPUTOVAMO as standard detection checklist in all minor attendees. SPUTOVAMO is an acronym composed of the first letters of the nine questions regarding the injury. An urgent problem with the use of diagnostic tools for physical child abuse, including SPUTOVAMO, is that comprehensive evidence on their accuracy is lacking. This thesis describes several aspects of the procedure of child abuse detection at ERs.

To adequately detect child abuse, knowledge, skills and a professional attitude are needed. In **chapter 2** we describe the results of a randomised controlled trial that evaluated the effectiveness of an electronic learning (e-learning) programme called 'The Next Page' on the performance of nurses in the recognition of child abuse in a simulated case in the Emergency Room. The study consisted of two groups: the intervention and the control group (i.e. the group that did not follow the e-learning programme). In both groups performance in simulated cases was measured as the primary outcome and self-efficacy as the secondary outcome. Outcomes measures were determined at baseline (the pre-test) and after the intervention group had been trained (the post-test). Nurses in the intervention group performed significantly better during the simulation than the untrained nurses and reported (non significant) higher self-efficacy. Both groups had a significant increase of the self-efficacy score in the post-test compared with the pre-test.

To draw a better picture of the current approach of child abuse detection at an ER, we describe the clinical process of child abuse detection at an academic ER in the year 2010 in **chapter 3**. Out of 3660 children (0-18 years) that attended the ER, in 65 cases (1.8%) there was a suspicion of child abuse. Eventually, two cases (3.1% of the suspected cases) were reported to Social Services.

The cornerstone of this thesis is the CHAIN-ER study (Child Abuse Inventory at Emergency Rooms) which aimed at assessing the diagnostic accuracy of the nationally implemented

SPUOVAMO-R checklist for physical abuse as primary outcome, and for neglect and need for help from social services as secondary outcome. SPUTOVAMO-R is the revised version of SPUTOVAMO.

**Chapter 4** describes the rationale and design of CHAIN-ER.

**Chapter 5** shows the results of CHAIN-ER. In this large multicentre study with a 6-months follow-up we included 4290 children aged 0-7 years attending the ER because of physical injury. All children were systematically tested with the index test. A national expert panel (reference standard) retrospectively assessed all checklist positive cases and a 15% random sample of the checklist negative cases for physical abuse, using additional information, namely, an injury history taken by a paediatrician, information provided by the general practitioner, youth doctor and social services by structured questionnaires, and 6-month follow-up information. The panel found three children to be intentionally injured (0.1%). All three cases were captured by SPUTOVAMO-R but at very high false positive rates. Subsequent assessment by child abuse experts can be safely restricted to checklist positives without missing any cases of inflicted injury. SPUTOVAMO-R also has a very high positive predictive value for the outcome “injury caused by neglect” but again against very high false positive rates. In addition, the inter-rater agreement for injury caused by neglect was very poor, indicating that it is not able to unequivocally diagnose injury due to neglect. Therefore, prediction of this outcome measure with SPUTOVAMO-R seems unfeasible in young children. SPUTOVAMO-R is not an accurate detection instrument for the outcome need for help from social services either.

In **Chapter 6** we discuss several subjects such as the difference between diagnosing child abuse and screening for risk factors for child abuse. In this chapter we also discuss the clinical implication of screening for child abuse in different levels of care.





## CHAPTER 8

### **Summary in Dutch** ***Nederlandse samenvatting***

## SAMENVATTING

Kindermishandeling heeft aanzienlijke korte- en langetermijneffecten voor de gezondheid en het welbevinden van het kind. Vroege opsporing van kindermishandeling kan ernstige gevolgen mogelijk voorkomen. Het is voorstelbaar dat een deel van de kinderen die lichamelijke mishandeld worden, zich vroeg of laat op een Spoedeisende Hulp (SEH) presenteert met een lichamelijke verwonding. Een SEH lijkt dus een logische plek om slachtoffers van lichamelijke kindermishandeling op te sporen. Internationaal worden diverse methoden gebruikt om kindermishandeling op de SEH op te sporen, maar het is nooit wetenschappelijk bewezen dat deze methoden doeltreffend zijn. In Nederland is het sinds 2009 voor alle SEH's verplicht om een instrument te gebruiken om te screenen op kindermishandeling. Een veel gebruikt instrument is de zogenoemde SPUTOVAMO-vragenlijst, die differentieert tussen de aan- of afwezigheid van een vermoeden op kindermishandeling. SPUTOVAMO is een acroniem van de letters van de oorspronkelijk negen vragen over het letsel. Hoewel (een versie van) SPUTOVAMO wijdverspreid gebruikt wordt, is ook voor dit instrument nooit onderzocht of het in staat is om te doen waarvoor het ontwikkeld is, namelijk een positieve uitkomst geven bij die kinderen bij wie het letsel toegebracht is en een negatieve uitkomst geven bij kinderen die niet mishandeld worden. In dit proefschrift worden verschillende aspecten van het opsporen van kindermishandeling beschreven.

Om kindermishandeling te herkennen, zijn kennis van het onderwerp, vaardigheden en een professionele houding nodig. Scholing met als doel de kennis, vaardigheden en professionele houding te verbeteren kan bijdragen aan een betere herkenning van kindermishandeling. In **hoofdstuk 2** beschrijven we de resultaten van een randomised controlled trial waarin het effect van het e-learningprogramma 'The Next Page' wordt onderzocht. Dit e-learningprogramma richt zich onder andere op het verbeteren van de herkenning door verpleegkundigen van (signalen van) kindermishandeling op een SEH. Twee groepen verpleegkundigen werden vergeleken: een groep die de e-learning gevolgd had en een controlegroep die de e-learning niet gevolgd had. Allen namen eerst ongetraind deel aan een scenario (pre-test). De ene groep kreeg vervolgens de training, de andere groep niet. Hierna namen allen weer deel aan een scenario (post-test). Verpleegkundigen die getraind waren middels The Next Page presteerden significant beter dan de ongetrainde verpleegkundigen, met name stelden ze adequatere vragen tijdens de anamnese. De self-efficacy-score, een score die hun eigen vertrouwen aangeeft in het juist kunnen handelen

in de gegeven situatie, verschilde niet significant tussen de getrainde en ongetrainde verpleegkundigen. Voor beide groepen geldt dat de self-efficacy-score significant hoger was ten tijde van de post-test dan ten tijde van de pre-test.

Om een beter beeld te geven van de werkwijze op SEH's, beschrijven we in **hoofdstuk 3** hoe de huidige screening op kindermishandeling in zijn werk gaat op de SEH van het Universitair Medisch Centrum in Utrecht (UMCU). We laten zien dat er veel overlap bestaat tussen deze werkwijze en de richtlijn die de American Academy of Pediatrics heeft geïntroduceerd. Van de 3660 kinderen die in 2010 op de SEH van het UMCU kwamen, was er in 65 casus (1.8%) sprake van een vermoeden op kindermishandeling. Twee kinderen werden uiteindelijk bij het Advies- en Meldpunt Kindermishandeling gemeld (3.1% van de vermoedens).

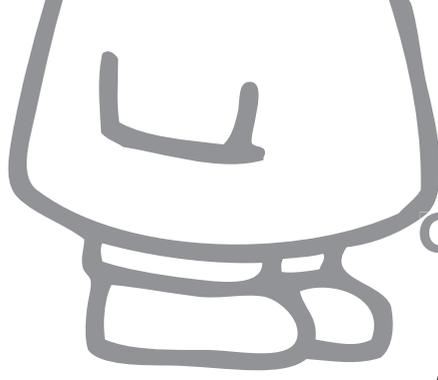
De hoeksteen van dit proefschrift is de CHAIN-ER-studie (Child Abuse Inventory at Emergency Rooms) waarin de diagnostische waarde van SPUTOVAMO-R onderzocht is. SPUTOVAMO-R is de gereviseerde versie van SPUTOVAMO. In **hoofdstuk 4** wordt de studieopzet van CHAIN-ER uitgebreid beschreven en in **hoofdstuk 5** worden de resultaten getoond. Gedurende achttien maanden includeerden we alle kinderen in de leeftijd van 0-7 jaar die zich met letsel op een van de deelnemende SEH's presenteerden. Voor al deze kinderen werd SPUTOVAMO-R (index-test) ingevuld. Voor alle kinderen met een positieve SPUTOVAMO-R-uitkomst en een random sample van 15% van de negatief gescreenden werd uitgebreide aanvullende informatie verzameld: een oudervragenlijst over onder andere gezinssamenstelling en socio-economische factoren, een aanvullende anamnese verricht door een gespecialiseerde kinderarts, vragenlijsten met risicofactoren ingeschat door de huisarts en jeugdarts, informatie over bekendheid bij het Advies- en Meldpunt Kindermishandeling en Bureau Jeugdzorg en eventuele follow-up-informatie. Alle gegevens werden aan een nationaal expertpanel voorgelegd (referentie test) die de diagnose 'lichamelijke kindermishandeling' stelde (primaire uitkomstmaat). In totaal werden 4290 kinderen geïnccludeerd in het onderzoek. In drie gevallen was er sprake van lichamelijke mishandeling (0.1%). We lieten zien dat het SPUTOVAMO-R-formulier alle casus van lichamelijke mishandeling ondervangt, maar wel met veel fout-positieve uitkomsten. Ook lieten we zien dat gespecialiseerde kindermishandelings-kinderartsen bij alleen de positieve SPUTOVAMO-R-uitkomsten in consult gevraagd kunnen worden, zonder dat een casus van lichamelijke mishandeling gemist wordt. Als secundaire uitkomstmaat gaf het expertpanel ook antwoord op de vraag of het letsel waarmee het kind op de SEH kwam het gevolg van nalatigheid van de ouders/verzorgers was en of er noodzaak tot hulpverlening

in brede zin was. Voor de uitkomst 'nalatigheid' vonden we net als voor de uitkomstmaat 'fysieke mishandeling' dat er geen casus gemist worden, maar dat er veel fout-positieve uitkomsten zijn. Een kanttekening die hierbij gemaakt moet worden is dat er veel onenigheid was tussen de expertpanelleden bij het stellen van de diagnose 'letsel als gevolg van nalatigheid'. Om die reden lijkt het niet zinvol om alle kinderen op de SEH systematisch te screenen op deze uitkomstmaat. Voor de uitkomstmaat 'noodzaak tot hulpverlening' geldt dat SPUTOVAMO-R in veel gevallen zowel onterecht positief als onterecht negatief is. Ook waren expertpanelleden het voor deze uitkomstmaat niet vaak eens met elkaar. Met andere woorden, voor deze uitkomstmaat is SPUTOVAMO-R niet geschikt als screeningsinstrument.

**Hoofdstuk 6** bevat een algemene discussie met daarin onder andere aandacht voor het verschil tussen de termen 'diagnosticeren' en 'screenen'. Ook laten we onze gedachten gaan over de mogelijkheden voor de verschillende settings waar opsporing van kindermishandeling kan geschieden.







## CHAPTER 9

### **Addendum**



# Appendix: questionnaires

## QUESTIONNAIRE FOR GENERAL PRACTITIONERS

### Your assessment

1. Do you have any suspicion of child abuse?

- Yes
- No
- Dubious
- No information available

2. Probability of child abuse in this family?

||-----||  
 Very low Very high

1. How many times has this child visited your practice with injury complaints in the last 12 months? \_\_\_\_\_
2. How many times has this child visited the outpatient clinic with injury complaints in the last 12 months? \_\_\_\_\_
3. How many times has this child visited the ER with injury complaints in the last 12 months? \_\_\_\_\_
4. How often the injury was unsatisfactory explained?

### Child

1. Since when do you know the child?
2. How many GP's did the child have prior to you?
3. Birth weight \_\_\_\_\_ Gramme
4. Prematurity (<37 weeks)?  Yes  No  Unknown
5. Difficulties during pregnancy/delivery?  Yes  No  Unknown
6. Adoption child/foster child?  Yes  No  Unknown
7. Baby colic?  Yes  No  Dubious  Unknown
8. Hyperactive child?  Yes  No  Dubious  Unknown
9. Chronically ill child?  Yes  No  Dubious  Unknown
10. Physically or mentally disabled child?  Yes  No  Dubious  Unknown
11. Behavioural problems?  Yes  No  Dubious  Unknown
12. Bad attachment to parents?  Yes  No  Dubious  Unknown
13. Failure to thrive, now or in the past?  Yes  No  Dubious  Unknown
14. Adiposity?  Yes  No  Dubious  Unknown

**Mother**

- |                                                      |                              |                             |                                  |                                  |
|------------------------------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Known at your practice?                           | <input type="checkbox"/> Yes | <input type="checkbox"/> No | (continue to 'father')           |                                  |
| 2. History of childhood abuse?                       | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Abuser in the past?                               | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 4. Chronically diseased?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 5. Psychiatric disorder, now or in the past?         | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. Alcohol addiction, now or in the past?            | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 7. Drugs addiction, now or in the past?              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 8. Young parent (<20y)?                              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 9. Unintended pregnancy (of this child)?             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 10. Negative attitude towards medical interventions? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 11. Low educational achievement?                     | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 12. Minimum income?                                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 13. Prolonged unemployed/incapacitated?              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 14. Poor social network?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |

**Father**

- |                                                      |                              |                             |                                  |                                  |
|------------------------------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Known at your practice?                           | <input type="checkbox"/> Yes | <input type="checkbox"/> No | (continue to 'family')           |                                  |
| 2. History of childhood abuse?                       | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Abuser in the past?                               | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 4. Chronically diseased?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 5. Psychiatric disorder, now or in the past?         | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. Alcohol addiction, now or in the past?            | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 7. Drugs addiction, now or in the past?              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 8. Young parent (<20y)?                              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 9. Unintended pregnancy (of this child)?             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 10. Negative attitude towards medical interventions? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 11. Low educational achievement?                     | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 12. Minimum income?                                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 13. Prolonged unemployed/incapacitated?              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 14. Poor social network?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |

**Family**

- |                                  |                              |                             |                                                                   |
|----------------------------------|------------------------------|-----------------------------|-------------------------------------------------------------------|
| 1. Single parent family?         | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Unknown                                  |
| 2. Reordered family?             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Unknown                                  |
| 3. Large family (>3 children)?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Unknown                                  |
| 4. Multiple birth in family?     | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Unknown                                  |
| 5. Poor housing?                 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious <input type="checkbox"/> Unknown |
| 6. History of domestic violence? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious <input type="checkbox"/> Unknown |
| 7. History of family stressor?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious <input type="checkbox"/> Unknown |

**Nurture**

- |                                                                                     |                              |                             |                                  |                                  |
|-------------------------------------------------------------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Serious problems with upbringing the child?                                      | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 2. Negative attitude towards the child?                                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Poor interaction between parent(s) and child?                                    | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 4. Cultural aspects contributing on the risk of child abuse?<br>(child punishments) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |

**Additional comments**

## QUESTIONNAIRE FOR YOUTH DOCTORS

### Child

- |                                            | Gramme                       |                              |                                  |                                  |
|--------------------------------------------|------------------------------|------------------------------|----------------------------------|----------------------------------|
| 1. Birth weight                            | <input type="checkbox"/> Yes | <input type="checkbox"/> No  |                                  | <input type="checkbox"/> Unknown |
| 2. Prematurity (<37 weeks)?                | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Difficulties during pregnancy/delivery? | <input type="checkbox"/> Yes | <input type="checkbox"/> No  |                                  | <input type="checkbox"/> Unknown |
| 4. Adoption child/foster child?            | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 5. Baby colic?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. Hyperactive child?                      | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 7. Chronically ill child?                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 8. Physically or mentally disabled child?  | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 9. Behavioural problems?                   | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 10. Bad attachment to parents?             | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 11. Failure to thrive, now or in the past? | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 12. Adiposity?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No  | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 13. Bad school attendance?                 | <input type="checkbox"/> N/a | <input type="checkbox"/> Yes | <input type="checkbox"/> No      | <input type="checkbox"/> Dubious |

### Parents

- |                                                             |                              |                             |                                  |                                  |
|-------------------------------------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Chronically diseased parent?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 2. Parent(s) addicted to alcohol, now or in the past?       | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Parent(s) addicted to alcohol, now or in the past?       | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 4. Parent(s) with psychiatric disorder, now or in the past? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 5. History of childhood abuse?                              | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. Abuser in the past?                                      | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 7. Young parent(s) (<20y)?                                  | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 8. Unintended pregnancy (of this child)?                    | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 9. Low educational achievement?                             | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 10. Minimum income?                                         | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 11. Prolonged unemployed/incapacitated?                     | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |

### Family

- |                                  |                              |                             |                                  |                                  |
|----------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Single parent family?         | <input type="checkbox"/> Yes | <input type="checkbox"/> No |                                  | <input type="checkbox"/> Unknown |
| 2. Reordered family?             | <input type="checkbox"/> Yes | <input type="checkbox"/> No |                                  | <input type="checkbox"/> Unknown |
| 3. Large family (>3 children)?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No |                                  | <input type="checkbox"/> Unknown |
| 4. Multiple birth in family?     | <input type="checkbox"/> Yes | <input type="checkbox"/> No |                                  | <input type="checkbox"/> Unknown |
| 5. Poor housing?                 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. History of domestic violence? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 7. Poor social network?          | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 8. History of family stressor?   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
- If yes: \_\_\_\_\_

### Nurture

- |                                                                                  |                              |                             |                                  |                                  |
|----------------------------------------------------------------------------------|------------------------------|-----------------------------|----------------------------------|----------------------------------|
| 1. Serious problems with upbringing the child?                                   | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 2. Negative attitude towards the child?                                          | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 3. Poor interaction between parent(s) and child?                                 | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 4. Cultural aspects contributing on the risk of child abuse? (child punishments) | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 5. Regular visit to youth health care?                                           | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Dubious | <input type="checkbox"/> Unknown |
| 6. Child known at social services?                                               | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> Unknown |                                  |

**Final assessment**

1. Do you have any suspicion of child abuse?

- Yes
- No
- Dubious
- No information available

2. Probability of child abuse in this family?

||-----||  
Very low Very high

**Additional comments**

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# Abbreviations

AAP	American Academy of Pediatrics
CAAT	Child Abuse Assessment Team
CAP	Child Abuse Paediatrician
CHAIN-ER	Child Abuse Inventory at Emergency Rooms
CI	confidence interval
CPS	child protection services
ED	emergency department
E-learning	electronic learning
ER	emergency room
ICC	intra-class correlation coefficient
NPV	negative predictive value
PPV	positive predictive value
QUADAS	Quality Assessment of Diagnostic Accuracy Studies
SCAN	Suspected Child Abuse and Neglect
SD	standard deviation
SPUTOVAMO-R	Acronym consisting of the first letters of the questions (in Dutch): <b>S</b> oort letsel/klacht: compatibel met verhaal en passend bij leeftijd kind? <b>P</b> ersisterend hetzelfde verhaal? <b>U</b> itstel in hulpzoeken zonder bevredigende verklaring? <b>T</b> op/teen onderzoek verdacht? <b>O</b> nverklaard (ander) letsel/klacht in VG? <b>V</b> ader / <b>m</b> oeder en kind: adequaat gedrag? <b>R</b> evised
STARD	Standards for the Reporting of Diagnostic Accuracy Studies
VAS	visual analogue scale



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# List of publications

## **This thesis**

Sittig JS, Post ED, Russel IMB, van Dijk IA, Nieuwenhuis EES, van de Putte EM. Evaluation of suspected child abuse at the ED; implementation of American Academy of Pediatrics guidelines in the Netherlands. *Am J Emerg Med.* 2014;32(1):64-66

Sittig JS, Uiterwaal CSPM, Moons KGM, Nieuwenhuis EES, van de Putte EM. Child abuse inventory at emergency rooms: CHAIN-ER rationale and design. *BMC Pediatr* 2011;11:91

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\* both authors were equally involved

Sittig JS, Uiterwaal CSPM, Moons KGM, Russel IMB, Nievelstein RAJ, Nieuwenhuis EES, van de Putte EM. Child abuse: the value of systematic screening at Emergency Rooms, *under review*

## **Other publications**

Kokke FT, Sittig JS, de Bruin A, Wiersma T, van Rijn RR, Kimpen JL, Houwen RH, Fischer K, Benninga MA. Starreveld scoring method in diagnosing childhood constipation. *Pediatr Radiol* 2010;40:1789-93

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# Curriculum Vitae

Judith Sittig was born on October 21, 1980 in Voorburg, the Netherlands.

After completing her secondary school (Gymnasium Haganum, The Hague) in 1999, she moved to Israel to study Hebrew at an ulpan in Ashkelon.

After a year she returned to the Netherlands for additional physics and chemistry courses at the James Boswell Institute in Utrecht.

In 2001 she started her medical studies at Utrecht University. She did several internships overseas, in "s Lands Hospitaal" in Paramaribo (Surinam), in "Ichilov Medical Center" in Tel Aviv (Israel) and at the ambulance service "Magen David Adom" in Be'er Sheva (Israel).

In January 2008 she started her PhD project called "Child Abuse Inventory at Emergency Rooms (CHAIN-ER)" under supervision of prof. dr. K.G.M. Moons, prof. dr. E.E.S. Nieuwenhuis, dr. E.M. van de Putte and dr. C.S.P.M. Uiterwaal.

In 2011 she obtained her Master of Science degree in Clinical Epidemiology at Utrecht University.

In January 2013 she started her residencies in paediatrics at St Antonius hospital in Nieuwegein under supervision of dr. W.A.F. Balemans.

As from October 2014 she continued her paediatric residency at the Wilhelmina Children's Hospital Utrecht, under supervision of dr. J. Frenkel.

Judith lives in Utrecht, together with her partner Marcel and their two children, Sara (2011) and Abe (2014).



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