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*Published in:*  
Child Abuse & Neglect

*DOI:*  
[10.1016/j.chiabu.2015.06.001](https://doi.org/10.1016/j.chiabu.2015.06.001)

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*Document Version*  
Publisher's PDF, also known as Version of record

*Publication date:*  
2015

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Bonvanie, I. J., van Gils, A., Janssens, K. A. M., & Rosmalen, J. G. M. (2015). Sexual abuse predicts functional somatic symptoms: An adolescent population study. *Child Abuse & Neglect*, 46, 1-7. <https://doi.org/10.1016/j.chiabu.2015.06.001>

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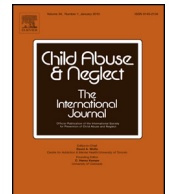
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## Research article

# Sexual abuse predicts functional somatic symptoms: An adolescent population study



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## ARTICLE INFO

## Article history:

Received 23 March 2015  
Received in revised form 8 June 2015  
Accepted 9 June 2015  
Available online 2 July 2015

## Keywords:

Medically unexplained symptoms  
Children  
Rape  
Gastrointestinal

## ABSTRACT

The main aim of this study was to investigate the effect of childhood sexual abuse on medically not well explained or functional somatic symptoms (FSSs) in adolescents. We hypothesized that sexual abuse predicts higher levels of FSSs and that anxiety and depression contribute to this relationship. In addition, we hypothesized that more severe abuse is associated with higher levels of FSSs and that sexual abuse is related to gastrointestinal FSSs in particular. This study was part of the Tracking Adolescents' Individual Lives Survey (TRAILS): a general population cohort which started in 2001 ( $N=2,230$ ; 50.8% girls, mean age 11.1 years). The current study uses data of 1,680 participants over four assessment waves (75% of baseline, mean duration of follow-up: 8 years). FSSs were measured by the Somatic Complaints subscale of the Youth Self-Report at all waves. Sexual abuse before the age of sixteen was assessed retrospectively with a questionnaire at T4. To test the hypotheses linear mixed models were used adjusted for age, sex, socioeconomic status, anxiety and depression. Sexual abuse predicted higher levels of FSSs after adjustment for age sex and socioeconomic status ( $B=.06$ ) and after additional adjustment for anxiety and depression ( $B=.03$ ). While sexual abuse involving physical contact significantly predicted the level of FSSs (assault;  $B=.08$ , rape;  $B=.05$ ), non-contact sexual abuse was not significantly associated with FSSs ( $B=.04$ ). Sexual abuse was not a stronger predictor of gastrointestinal FSSs ( $B=.06$ ) than of all FSSs. Further research is needed to clarify possible mechanisms underlying relationship between sexual abuse and FSSs.

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## Introduction

Functional somatic symptoms (FSSs), or symptoms that are not well explained by an underlying pathology, are common in adolescence and can be very persistent and impairing (Hunfeldt et al., 2001; Perquin et al., 2003). In children and adolescents gastrointestinal complaints, pain, and fatigue are the most common symptoms (Perquin et al., 2003; Saps et al., 2009; ter Wolbeek et al., 2006). The aetiology of FSSs is not well understood, but several social, psychological and biological risk factors have already been identified (Beck, 2008; Janssens et al., 2010, 2014). One of these potential risk factors for FSSs is sexual abuse (Afari et al., 2014; Davis, Luecken, & Zautra, 2005; Kugler et al., 2012; Paras et al., 2009; van Tilburg et al., 2010). Yet,

*Abbreviations:* FSSs, functional somatic symptoms; LMMs, linear mixed models; SES, socioeconomic status; TRAILS, Tracking Adolescents' Individual Lives Survey.

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previous studies that investigated the effect of sexual abuse on FSSs mostly relied on cross-sectional analyses of recalled sexual abuse and current FSSs (Afari et al., 2014; Paras et al., 2009). This may have introduced biases. For example; people who suffer from anxiety, depression, or FSSs may more easily recall negative events that triggered the same mood or resulted in the same symptoms (Blaney, 1986). In addition, often the effect of sexual abuse on one specific type of FSSs in female clinical populations was studied (Afari et al., 2014; Paras et al., 2009). Thus, it remains unclear if the recall of sexual abuse predicts a spectrum of prospectively assessed FSSs in the general adolescent population.

Further, most studies did not adjust for concurrent symptoms of anxiety and depression or chronic stressors. Yet, symptoms of anxiety and depression may (partly) explain the association between sexual abuse and FSSs (Chen et al., 2010; Janssens et al., 2010). Indeed, in the two studies in adolescents that adjusted for symptoms of anxiety and/or depression, the association between sexual abuse and FSSs was reduced or no longer significant (Kugler et al., 2012; van Tilburg et al., 2010). Furthermore, the effect of sexual abuse on FSSs might depend on the type of abuse that was experienced, such as abuse involving contact versus abuse without bodily contact, but not much has been written on this topic (Bendixen, Muus, & Schei, 1994; Leserman et al., 1996; Paras et al., 2009). Finally, a meta-analysis found that sexual abuse and gastrointestinal complaints, but not headache or fibromyalgia, were related in adults (Paras et al., 2009). This raises the question whether sexual abuse might be a risk factor for gastrointestinal FSSs in particular.

This study investigates the relation between sexual abuse and a spectrum of prospectively assessed FSSs in a large population-based cohort of Dutch adolescents. It was hypothesized that (1) sexual abuse predicts higher levels of FSSs; (2) symptoms of anxiety and depression explain at least part of this relationship; (3) sexual abuse involving contact predicts a higher level of FSSs than sexual abuse not involving contact. In addition this study explored if sexual abuse is related to gastrointestinal symptoms in particular.

## Methods

### Participants

This study was part of the Tracking Adolescents' Individual Lives Survey (TRAILS), a prospective population based cohort recruited from five municipalities in the North of the Netherlands (de Winter et al., 2005). In total 3,483 potential participants from 135 primary schools were identified based on their date of birth. Schools, parents and children were informed and all had to agree to participate for inclusion. Children incapable of participating due to mental retardation, serious physical illness or handicap were excluded from the study, as were children with no Dutch, Turkish or Moroccan speaking parent or guardian. At baseline in 2001, 2,230 children were included (mean age 11.1 years [ $SD = 0.6$ ]). Extensive recruitment efforts were made to increase the representativeness of the cohort. No differences were found between responders and non-responders in sociodemographic factors and health outcomes (de Winter et al., 2005). Data from four assessment waves were used for this study (T1–T4, T2: mean time to follow up 2.5 years, mean age 13.6 years [ $SD = 0.5$ ]; T3: mean time to follow up 5.2 years, mean age 16.3 years [ $SD = 0.7$ ]; T4: mean time to follow up 8.0 years, mean age 19.1 years [ $SD = 0.6$ ]). Data on sexual abuse were collected for 1,680 participants at T4 (Table 1). Attrition over the four waves was associated with being male, a low socioeconomic status, peer problems, substance use and externalizing problems (Nederhof et al., 2012). A more detailed description of the recruitment efforts, population characteristics and non-response bias can be found elsewhere (de Winter et al., 2005; Huisman et al., 2008; Nederhof et al., 2012). Approval by the Dutch Central Committee on Research Involving Human Subjects was obtained. Written informed consent was given by parents at T1 and by adolescents at T2, T3 and T4.

### Measures

**Functional Somatic Symptoms.** FSSs were assessed with nine items of the Somatic Complaints subscale of the Youth Self-report (YSR) at T1–T4 (Achenbach, Dumenci, & Rescorla, 2003). The YSR has been shown to have a good cross-cultural validity (de Groot, Koot, & Verhulst, 1996). The items refer to somatic symptoms without a known medical cause or without an obvious

**Table 1**  
Characteristics of the study sample.

Characteristic	T1	T2	T3	T4
Subjects, <i>N</i> (% T4)	1,658 (99%)	1,642 (98%)	1,466 (87%)	1,680 (100%)
Female subjects, <i>n</i> (%) <sup>a</sup>	912 (55.0%)	898 (54.7%)	812 (55.4%)	921 (54.8%)
Age, mean years ( <i>SD</i> )	11.1 (0.6)	13.5 (0.5)	16.2 (0.7)	19.1 (0.6)
FSSs, mean ( <i>SD</i> )	0.47 (0.35)	0.40 (0.36)	0.35 (0.34)	0.20 (0.31)
Sexually abused, <i>N</i> (%) <sup>a</sup>	30 (1.8%)	58 (3.4%)	138 (8.3%)	154 (9.2%)
FSSs sexually abused, mean ( <i>SD</i> )	0.61 (.36)	0.58 (.48)	0.53 (.41)	0.32 (0.41)
Sexually abused females, <i>n</i> (%) <sup>b</sup>	23 (2.5%)	46 (5.0%)	108 (11.7%)	120 (13.0%)
Sexually abused males, <i>n</i> (%) <sup>b</sup>	7 (0.9%)	12 (1.6%)	30 (4.0%)	34 (4.5%)

Note: T1–T4 represent the four assessment waves. FSSs, functional somatic symptoms.

<sup>a</sup> Percentages based on the total number of participants who attended the corresponding wave.

<sup>b</sup> Percentages based on the total number of females/males who attended the corresponding wave.

**Table 2**  
Incidence of the five forms of sexual abuse.

	Valid N	T1 n (%)	T2 n (%)	T3 n (%)	T4 n (%)
Non-contact	1,645	21 (1.3)	38 (2.3)	86 (5.2)	98 (6.0)
Being touched	1,645	22 (1.3)	40 (2.4)	87 (5.3)	96 (5.8)
Forced to touch	1,646	15 (0.9)	24 (1.5)	42 (2.6)	50 (3.0)
Attempted rape	1,679	10 (0.6)	18 (1.1)	51 (3.0)	62 (3.7)
Rape	1,680	7 (0.4)	13 (0.8)	43 (2.6)	54 (3.2)

Note: T1–T4 represent the four assessment waves.

reason in the past six months; pain, headache, stomachache, nausea, vomiting, eye problems, skin problems, dizziness, and fatigue. Participants indicated whether they experienced these complaints *never* (0), *sometimes or a bit* (1) or *often or a lot* (2). Factor analyses showed that the items 'eye problems' and 'skin problems' had low factor loadings at all assessment waves (Janssens et al., 2014a), suggesting that these items do not accurately represent the underlying construct of FSSs. Therefore, these items were excluded. The remaining seven items at T1–T4 showed good internal consistency with Cronbach's alpha T1: 0.76, T2: 0.77, T3: 0.75, T4: 0.79. The average score of these 7 items was used as a continuous outcome measure (range 0–2).

In the YSR questionnaire at T4, there was a difference between the online and the paper-and-pencil questionnaire presented to participants (Janssens et al., 2014). In the online version, the somatic complaints subscale was preceded by a screening question referring to somatic symptoms without a known cause or obvious reason in the past 6 months. For the participants who filled in they had *never* experienced those somatic symptoms, five items (pain, headache, stomachache, nausea and vomiting) of the YSR somatic symptom scale were not shown and all automatically set to *never*. The two items dizziness and fatigue were assessed apart from this screening question, and were therefore assessed similarly in the online and the paper-and-pencil questionnaire. Because of this additional screening question in the online version, participants who filled in the online questionnaire ( $N = 1,395$ , 82%) scored substantially lower on FSSs than participants using the paper-and-pencil questionnaire (independent  $t$ -test: difference = 0.11,  $p < .01$ ). To correct for the difference in method, 'type of questionnaire' was included as a covariate in all analyses.

**Sexual Abuse.** At T4 a traumatic youth experience questionnaire was filled out by the participants. In line with the Dutch definition of childhood sexual abuse, the questionnaire refers to sexual abuse before the age of 16. The questionnaire contains five items referring to sexual abuse by an adult family member, acquaintance of the family, or stranger (items listed in Table 2). Each question could be answered with *never*, *happened once*, or *happened more than once*. All questions were followed by the question 'At what age did this happen?'. In agreement with previous literature (Barth et al., 2012; Bendixen et al., 1994; Leserman et al., 1996; Paras et al., 2009; Zink et al., 2009), a hierarchic scale consisting of *never experienced any form of sexual abuse* (0), *only experienced non-contact sexual abuse* (1), *experienced at least one form of contact abuse but no rape* (2) and *experienced rape* (3) was constructed. Because of the known age of the participants at each assessment wave and the retrospectively self-reported age of abuse, it could be reconstructed before which wave(s) the abuse took place. In some cases, the age of the participant at the time of the sexual abuse experience was similar to the age of the participant at a certain wave (T1: 9 participants, T2: 17 participants, T3: 16 participants). In these cases it remained unclear whether this type of sexual abuse took place before or after the participant filled in the somatic complaints questionnaire for that wave. Therefore, the score on the sexual abuse scale was reported as unknown (missing) for that particular wave and the higher scores on the sexual abuse scale were reported only at the following waves.

**Anxiety and Depression.** Symptoms of anxiety and depression in the past six months were assessed with the YSR DSM-IV Anxiety (six items) and Depression (thirteen items) subscales at T1–T4 (Achenbach et al., 2003; Ferdinand, 2008). The item 'overtiredness' was excluded from the Depression scale to prevent overlap with the Somatic Complaints subscale.

**Socioeconomic Status.** Sexual abuse often occurs in the context of other stressors (MacMillan et al., 2013; Mills et al., 2013). One way of taking other ongoing stressors into account is adjustment for socioeconomic status (SES) (Sedlak et al., 2010). In line with previous research (Oakes & Rossi, 2003), SES was assessed using data on household income, educational level of both parents and occupational level of both parents using the International Standard of Classification of Occupations (Ganzeboom & Treiman, 1996). These five indicators were documented at baseline and at T4. They were combined into one SES measure at T1, used at T1–T3, and one SES measure at T4, used at T4.

### Statistical Analysis

Analyses were performed using SPSS 20.0. Linear mixed models (LMMs) were used to study the influence of sexual abuse on the level of FSSs during adolescence (Brady & West, 2009). Outcome variables were mean FSSs scores at T1–T4. Sexual abuse, age, sex, SES and type of questionnaire were entered as fixed factors. A random intercept was included. To study the contribution of symptoms of anxiety and depression to the relationship between sexual abuse and FSSs, anxiety

**Table 3**  
Linear mixed models: the association of sexual abuse with functional somatic symptoms.

Predictors	B	95% CI	p
Intercept	.19	[.17, .22]	.001
Sex: female	.13	[.10, .15]	.001
Age	-.03	[-.03, -.02]	.001
SES	-.02	[-.04, -.01]	.002
Sexual abuse	.06	[.04, .08]	<.001

Note: Linear mixed models are adjusted for type of questionnaire. Age is centred at 14.78. SES, socioeconomic status.

and depression were added to the model as fixed factors. The Bayesian information criterion was used to define the best fitting model. To study the relationship between sexual abuse and FSSs over time, the interaction term 'age\*sexual abuse' was added. Before doing this age was centred at the mean age of all four assessment waves (14.78) in order to make useful interpretations of possible outcomes. The effect of the type of abuse on the level of FSSs was studied by entering the categories of the hierarchic sexual abuse scale as separate dummies in the model. To examine the effect of sexual abuse on the level of gastrointestinal FSSs the mean gastrointestinal FSSs item scores were studied as outcome variables. All predictors were included simultaneously in the LMMs analyses. The unstandardized estimates, *B* values, are displayed to describe the associations of the predictors with the main outcome variable FSSs. *P*-values < .05 were considered statistically significant. Because the FSSs mean item scores at T4 and gastrointestinal FSSs mean item scores on all waves were skewed in the sample, bootstrapping was used to verify the estimates of *B*s and their confidence intervals for the parameters in the LMMs (Wright, London, & Field, 2011). Ten thousand bootstrap samples were performed per analysis.

## Results

### Sample Characteristics

The characteristics of the sample of 1,680 participants are shown in Table 1. The mean FSSs score declined over time. The drop of mean FSSs scores between T3 and T4 is partly due to the change in format of the questionnaire described in the method section. In this sample, 154 participants experienced some form of sexual abuse before the age of 16. Thirty participants experienced sexual abuse before T1, 18 were sexually abused between T1 and T2, 80 between T2 and T3, and 16 participants between T3 and T4. Please note that most participants were already 16 at T3 which might explain the low number of new cases of sexual abuse between T3 and T4. Age of onset of sexual abuse ranged between 2 and 15 years old ( $M = 12.4$  years,  $SD = 3.2$ ) with a peak incidence in 14 and 15 year olds ( $n = 83$ , 54%). The incidence of the five different forms of sexual abuse is shown in Table 2. When participants were divided in the three groups used for the hierarchic scale, 35 participants (23%) experienced non-contact sexual abuse only, 65 participants (42%) experienced at least one form of sexual abuse involving assault but no rape and 54 participants (35%) experienced rape. In total, 51% of all abused participants reported to have experienced at least one specific form of sexual abuse more than once.

### Sexual Abuse and FSSs during Adolescence

To assess the influence of sexual abuse on FSSs during adolescence, LMMs with FSSs (T1–T4) as outcomes were used. Sexual abuse significantly predicted a higher level of FSSs during adolescence when adjusted for age, type of questionnaire, sex and SES (Table 3). The interaction term 'age\*sexual abuse' did not significantly predict FSS, meaning that the effect of sexual abuse did not change over time. When symptoms of anxiety and depression were also taken into account, the strength of the relationship between sexual abuse and FSSs was affected but remained significant ( $B = .03$ , 95% CI [.02, .05],  $p < .001$ ). Bootstrapping yielded similar results.

### Type of Sexual Abuse and FSSs

In order to test the effect of the type of abuse on FSSs the hierarchic scale in the form of dummies as separate predictors was entered in the LMMs. Having experienced assault or (also) rape predicted a higher level of FSSs, while having experienced non-contact sexual abuse was not significantly related to FSSs (Table 4). Bootstrapping yielded similar results.

### Sexual Abuse and Gastrointestinal FSSs

To study the influence of sexual abuse on gastrointestinal FSSs in particular, LMMs with gastrointestinal FSSs as outcome variables were used. Sexual abuse significantly predicted the level of gastrointestinal symptoms during adolescence ( $B = .06$ , 95% CI [.04, .08],  $p < .001$ ). However, the size of this effect was similar to the effect of sexual abuse on the broader spectrum of FSSs as shown in Table 3. Bootstrapped analyses gave essentially the same results.

**Table 4**  
Linear mixed models: the effect of the severity of sexual abuse on functional somatic symptoms.

Predictors	B	95% CI	p
Intercept	.20	[.17, .22]	.001
Sexual abuse 'non-contact'	.04	[–.05, .12]	.39
Sexual abuse 'assault'	.08	[.05, .12]	<.001
Sexual abuse 'rape'	.05	[.03, .08]	<.001

Note: Results of linear mixed models adjusted for: age, gender, socioeconomic status and type of questionnaire.

## Discussion

This study suggests that sexual abuse predicts higher levels of FSSs during adolescence when adjusting for age, sex and SES. Additional adjustment for symptoms of anxiety and depression affected the strength of this relationship. When the effect of abuse type on the level of FSSs was studied, contact sexual abuse predicted a higher level of FSSs while no significant association of non-contact sexual abuse with FSSs was found. Finally, the effect of sexual abuse was not more prominent in gastrointestinal FSSs than in a broader spectrum of FSSs.

This study has several strengths. First, the large population-based cohort makes it credible that the findings are generalizable to the population. The prevalence of FSSs found in this study was largely similar to previous studies in the general adolescent population, which further strengthens this assumption (Perquin et al., 2003; Saps et al., 2009; ter Wolbeek et al., 2006). In addition, the variable FSSs was composed of a spectrum of FSSs and the hierarchic sexual abuse scale used in this study reduced the loss of information. This probably reflects both variables more accurately than labelling them as absent or present. Third, FSSs were prospectively assessed which reduced the chance of report bias. Finally, the analyses were adjusted for SES and symptoms of anxiety and depression.

When interpreting the results the following limitations should be taken into account. First, FSSs were measured with a questionnaire and asked for symptoms 'without an obvious reason' or 'without a known medical cause'. Hence, it cannot be ruled out that some FSSs were actually medically explained symptoms. Second, sexual abuse was assessed retrospectively, an inevitable problem because the ethics committee did not approve confronting children with these types of questions before the age of 16. This has probably led to a small underestimation of the prevalence of sexual abuse (Everson et al., 2008), and may have caused some inaccurate answers with regard to the age of the participant at the time that the sexual abuse occurred. The use of records of child protective services (CPS) would have solved the inaccuracy, but CPS substantially underestimate the prevalence of sexual abuse (Everson et al., 2008), and might introduce selection bias. However, imprecise recollection of the age of onset of the abuse would probably only have weakened the association between sexual abuse and FSSs. Third, there was no information about possible non-response or drop-out rates of abused children or children with severe FSSs. Though, if sexually abused participants or participants with severe somatic complaints would be more prone to drop-out, this would again probably only have weakened the found association. Moreover, the prevalence of sexual abuse found in the sample of this study was only in the lower range of what previous studies reported, and would probably have been higher if sexual abuse before the age of 18 instead of the age of 16 was assessed in this study (Barth et al., 2012). Finally, when interpreting the findings of this study it should be acknowledged that detailed information about the sexual abuse, such as frequency, duration or perceived psychological impact, was not available. Therefore, the hierarchic scale may reflect more underlying characteristics of sexual abuse than severity in terms of the type of sexual abuse alone. Furthermore, the found associations of sexual abuse with FSSs were not adjusted for other types of childhood abuse. This may have led to some overestimation of the associations between sexual abuse and FSSs.

To the best of our knowledge, no previous studies have investigated the effect of sexual abuse on a spectrum of FSSs in the general adolescent population. Two previous studies found that multiple unfavourable household circumstances and adversities, including sexual abuse, were associated with the occurrence of FSSs in adolescents (Flaherty et al., 2009, 2013). Several other studies found that sexual abuse was associated with specific types of FSSs in adolescents (Bendixen et al., 1994; Devanarayana et al., 2014; Holmberg & Hellberg, 2010; van Tilburg et al., 2010; Zafar et al., 2012). In addition, a history of sexual abuse was found to be associated with a spectrum of FSSs in children placed in a high care foster home (Kugler et al., 2012). Only one study additionally adjusted the effect of sexual abuse on gastrointestinal FSSs for symptoms of anxiety and depression, and found that these symptoms fully explained the effect (van Tilburg et al., 2010). Thus, it seems that the effect of sexual abuse on FSSs is at least partly explained by symptoms of anxiety and depression. It could be that the mediating role of symptoms of anxiety and depression is greater for some particular FSSs such as gastrointestinal FSSs.

Further research is needed to identify mechanisms, next to symptoms of anxiety and depression, underlying the relationship between sexual abuse and FSSs. One such potential mechanism could be that the chronic stress caused by sexual abuse results in alterations in hypothalamic-pituitary-adrenal axis functioning. These alterations can cause low cortisol stress-responses (Heim et al., 2009). A low cortisol level is thought to be an underlying factor of some FSSs (Janssens et al., 2012; Tak et al., 2011).

In some previous studies it was suggested that the effect of sexual abuse on FSSs might depend on the type of the abuse (Bendixen et al., 1994; Leserman et al., 1996), but this study could not fully confirm these findings. In this study, contact sexual abuse was indeed related to FSSs while non-contact sexual abuse was not (Leserman et al., 1996). However, assault



not involving rape had the strongest association with FSSs. There are several possible reasons why especially sexual abuse involving contact was related to FSSs. For example, it could be that abuse involving contact triggers physical distress while abuse without contact does not.

The results of this study indicate that the effect of sexual abuse on gastrointestinal FSSs is similar to the effect of sexual abuse on a broader spectrum of FSSs. In contrast, a previous meta-analysis found a significant relationship of sexual abuse with chronic gastrointestinal complaints but not with fibromyalgia and headache in adults (Paras et al., 2009). However, the few studies investigating sexual abuse in relation to FSSs may have lacked the power to show a significant association in this meta-analysis. On the other hand, in the current study the effect of sexual abuse on FSSs was not adjusted for other types of abuse, which may have reduced the power to detect a specific effect of sexual abuse on gastrointestinal symptoms. Previous studies in adolescents mainly focused on gastrointestinal FSS and could therefore not make this comparison (Bendixen et al., 1994; Devanarayana et al., 2014; Holmberg & Hellberg, 2010; Kugler et al., 2012; van Tilburg et al., 2010).

The findings of this study suggest that sexual abuse is associated with higher levels of FSSs in adolescents. Symptoms of anxiety and depression explained part of the effect of sexual abuse on FSSs. In addition, findings indicate that sexual abuse is related to a broad spectrum of FSSs and not only to particular symptoms. If these findings are replicated, FSSs might be seen as a supplementary signal when childhood sexual abuse is suspected. However, it is important to keep in mind that sexual abuse explains only a small part of the variance in FSS and most adolescents with FSSs were not sexually abused (in this sample the positive predictive value of experiencing at least one FSS often, or two FSSs sometimes, was 14% at T4). Further research is needed to investigate to what extent sexual abuse in adolescence predicts clinically relevant FSSs (e.g. functional impairment and health care visits), and how FSSs are related to other types of abuse.

### Competing Interests

The authors have no potential conflicts of interest to disclose. The authors have no financial relationships relevant to this article to disclose.

### Funding

TRAILS has been financially supported by various grants from the Netherlands Organization for Scientific Research (NWO), the Dutch Ministry of Justice, the European Science Foundation, Biobanking and Biomolecular Resources Research Infrastructure, the Gratama foundation, the Jan Dekker foundation, the participating universities, and Accare Center for Child and Adolescent Psychiatry.

### Acknowledgments

This research is part of the TRacking Adolescents' Individual Lives Survey (TRAILS). Participating centers of TRAILS include various departments of the University Medical Center and University of Groningen, the Erasmus University Medical Center Rotterdam, the University of Utrecht, the Radboud Medical Center Nijmegen, and the Parnassia Bavo group, all in the Netherlands. We are grateful to all adolescents, their parents, and teachers who participated in this research, and to everyone who worked on this project and made it possible.

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