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Insomnia symptom trajectories among adult survivors of childhood sexual abuse: A longitudinal study

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ABSTRACT

Background: Childhood sexual abuse (CSA) is associated with sleep disturbances in adulthood. However, longitudinal studies have yet to identify among CSA-survivors subgroups distinguished by the trajectory of their insomnia severity, or predictors of subgroup membership.

Objective: The objective of this study was to examine longitudinal insomnia symptom trajectories, as well as predictors and correlates of the identified trajectories, over a 4 year study period in a sample of adult, mainly female CSA-survivors.

Participants and setting: The sample comprised 533 adult survivors of CSA (94.9% women, mean age 39.2 years, mean age of abuse onset 6.5 years), recruited from support centers for sexual abuse survivors in Norway.

Methods: Latent class growth analyses were used to identify insomnia symptom trajectories.

Results: Three distinct trajectories of insomnia symptoms were identified; one characterized by high insomnia symptom scores minimally decreasing over the study period (*high and decreasing*, 30.6%), one characterized by stable intermediate insomnia symptom scores (*intermediate and stable*, 41.5%), and one characterized by stable low insomnia symptom scores (*low and stable*, 27.9%). Predictors of belonging to the *high and decreasing* trajectory (using the *low and stable* trajectory as a reference), was lower age of abuse onset (exponentiated coefficient (EC): 0.93, $p = 0.026$), abuse involving penetration (EC: 2.36, $p = 0.005$), threats (EC: 3.06, $p < 0.001$) or physical violence (EC: 3.29 $p < 0.001$), a higher score on a composite variable comprising multiple other abuse and perpetrator aspects (EC: 2.55, $p < 0.001$), as well as scoring above a clinical cut-off on a measure of posttraumatic stress symptoms (EC: 12.17, $p < 0.001$). Those belonging to the *high and decreasing* trajectory also reported lower levels of perceived social

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support and higher levels of subjectively experienced relational difficulties compared to those belonging to the two other trajectories.

Conclusions: We conclude that different longitudinal insomnia trajectories exist among adult CSA survivors. The overall results, as well as the significant predictors, are discussed alongside their potential clinical implications.

1. Introduction

Childhood sexual abuse (CSA) is highly prevalent worldwide, with reported prevalence rates ranging from 8 to 31% in women and 3–17% in men internationally (Barth, Bermetz, Heim, Trelle, & Tonia, 2013; Finkelhor, 1994; Pereda, Guilera, Forns, & Gómez-Benito, 2009; Singh, Parsekar, & Nair, 2014; Stoltenborgh, van Ijzendoorn, Euser, & Bakermans-Kranenburg, 2011). A large literature links a history of CSA to a significant public health burden reflected by increased life-long risk for developing a wide range of mental and somatic disorders (Chen et al., 2010; Fergusson, McLeod, & Horwood, 2013; Finkelhor, 1990; Maniglio, 2009; Paras et al., 2009), altered neurobiology and stress physiology (Dannowski et al., 2012; Heim, Newport, Heit et al., 2000; Hulme, 2011; Kendler, Kuhn, & Prescott, 2004; Vythilingam et al., 2002), and immense societal costs (Bonomi et al., 2008; Hulme, 2000; Saied-Tessier, 2014; Walker et al., 1999).

Among the health problems found at augmented rates among CSA-survivors, is insomnia (Kajeepeta, Gelaye, Jackson, & Williams, 2015; Lind, Aggen, Kendler, York, & Amstadter, 2016; Steine, Harvey et al., 2012). Insomnia is defined by the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders as difficulties in initiating, maintaining sleep or early morning awakenings resulting in significant distress or impairment in daytime functioning (American Psychiatric Association, 2013). Sleep is vital for our health, recuperation and well-being. An extensive literature has documented the negative consequences of disturbed sleep in term of health and daytime functioning, including studies reporting associations between both sleep duration and sleep quality with all-cause mortality (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Dew et al., 2003; Kripke, Garfinkel, Wingard, Klauber, & Marler, 2002), suicide and suicide attempts (Pigeon, Pinquart, & Conner, 2012), systemic inflammation (Irwin, Olmstead, & Carroll, 2015), work-related injuries (Uehli et al., 2014), work-absenteeism, impaired memory and concentration, as well as functional impairments and reduced quality of life (Roth & Ancoli-Israel, 1999). Moreover, sleep disturbances are common across a wide range of mental health disorders, and are increasingly recognized as a plausible transdiagnostic factor playing an essential role in the etiology and maintenance of many disorders (Benca, Obermeyer, Thisted, & Gillin, 1992; Dolsen, Asarnow, & Harvey, 2014; Harvey, 2008; Harvey, Murray, Chandler, & Soehner, 2011).

While the exact mechanistic pathways linking CSA to insomnia are not yet fully understood, several potential causal pathways are plausible. For example, insomnia among adult CSA-survivors may reflect *psychophysiological hyperarousal* (Riemann et al., 2010) due to hyperactivity of the hypothalamus-pituitary-adrenal cortex (HPA)-axis (Heim, Newport, & Heit, 2000; Heim, Newport, Bonsall, Miller, & Nemeroff, 2001; Hulme, 2011), a brain system with a recognized role in regulating the sleep/wake cycle (Van Reeth et al., 2000). In support of this, studies have reported brain activity indicative of central nervous system hyperarousal during sleep among childhood maltreatment survivors (Bader, Schafer, Nissen, & Schenkel, 2013). Hyperarousal is also one of the core symptoms of posttraumatic stress disorder (PTSD) (American Psychiatric Association, 2013), which is found at augmented rates among CSA-survivors. Another potential pathway underlying the association between CSA and insomnia in adulthood, is that insomnia symptoms may reflect negative (learned) associations with the bedtime/bed/sleep environment (Hauri & Fisher, 1986). Specifically, if CSA was occurring after bedtime or in the bed/sleep environment, the bed/sleep environment may be associated with fear, anxiety and wakefulness, in line with a stimulus control model of insomnia (Bootzin, 1972). In support of this, a study reported that experiencing trauma in a sleep-related context was associated with a greater risk for residual insomnia following successful treatment of PTSD (Zayfert & DeViva, 2004).

Despite the recognized importance of sleep for health and well-being, several knowledge gaps exist in the current literature on sleep disturbances among CSA-survivors. While numerous studies have documented a high prevalence of sleep disturbances in this population, many have been limited by small samples and the use of unstandardized sleep measures (Kajeepeta et al., 2015; Lind et al., 2016; Steine, Harvey et al., 2012). Moreover, there is a paucity of studies examining risk and protective factors associated with individual differences in sleep disturbance outcomes following CSA, as well as studies using longitudinal designs. The following sections provide a summary of the current knowledge status in this field.

1.1. Risk and protective factors

Only a couple of studies have examined risk and protective factors, such as abuse- perpetrator- and victim related factors or perceived social support, for individual differences in insomnia symptoms among CSA-survivors. In their representative sample of 8179 adult twins, Lind et al. (2016) found that CSA was associated with an increased risk of insomnia in adulthood (25–30 years after the abuse took place). Predictors of insomnia severity were having felt threatened or forced, reporting more than one perpetrator, as well as reporting female or mixed gender perpetrators (Lind et al., 2016). In a representative community sample of 492 sexually abused men and women, Heath, Bean, and Feinauer (1996) found that abuse involving penetration was associated with reporting more sleep disturbance symptoms (Heath et al., 1996). With regards to the role of perceived social support for individual differences in insomnia symptom severity, we are aware of only one previous study (from our research group) addressing this issue. In that study,

we found that abuse involving penetration was positively related to insomnia symptoms, and that perceived social support was inversely associated with insomnia symptoms in a sample of 460 survivors of child and adult sexual abuse (Steine, Krystal et al., 2012).

Of the few previously conducted longitudinal studies (Calam, Horne, Glasgow, & Cox, 1998; Dubowitz, Black, Harrington, & Verschoore, 1993), we are aware of only one study reporting the course of sleep disturbance symptoms across time. In that study, Calam et al. (1998) reported in their sample of 144 sexually abused children aged 16 and below, that the proportion of children displaying sleep disturbances increased with time, from 20% at baseline assessments to 34% and 33% at nine-month and two-year follow-ups, respectively. However, no risk or protective factors were examined in that study (Calam et al., 1998).

1.2. Insomnia symptom trajectories

While the abovementioned studies are effective in documenting CSA as a risk factor for long-term sleep disturbances, none examined whether different symptom severity subgroups could be identified within the samples, providing little information about heterogeneity in terms of insomnia symptomatology. Thus, more knowledge on different insomnia severity sub-groups and predictors of such sub-groups among CSA-survivors is warranted, since this may advance our understanding about risk and protective factors contributing to individual differences in insomnia symptoms long-term in this population. Such knowledge is also of practical importance, as it can inform early intervention frameworks by aiding clinicians in identifying sub-groups of individuals with a higher risk and vulnerability for long-term insomnia symptoms, especially in light of the limited resources available in standard clinical settings. To our knowledge however, no longitudinal studies so far have examined potential insomnia symptom severity subgroups, or predictors of such subgroups, among CSA-survivors, highlighting the need for studies addressing this issue.

1.3. Study aims and hypotheses

The aim of the present study was to examine longitudinal insomnia symptom trajectories, as well as predictors and correlates of the identified trajectories, among adult survivors of CSA. Due to the lack of previous studies examining insomnia symptom trajectories in this group, no *a priori* hypotheses were made regarding the specific number of trajectories that could be identified. However, based on previous longitudinal studies reporting individual differences in levels of insomnia symptoms among CSA-survivors, we hypothesized that at least two different insomnia symptom trajectories would emerge in our sample: One characterized by low insomnia symptom scores, and one characterized by moderate/high insomnia symptom scores. Informed by the previously conducted studies examining risk and protective factors contributing to individual differences in insomnia symptoms, we also hypothesized that abuse involving threats, the use of force, and penetrative abuse would be positively associated with the trajectory characterized by moderate/high insomnia symptom scores. We also hypothesized that abuse involving a close relation to the perpetrator and physical violence would be positively associated with belonging to the moderate/high symptom trajectory. With regards to perceived social support, we hypothesized that lower levels of perceived social support would be associated with belonging to the moderate/high insomnia symptom trajectory. Finally, we wanted to explore the association of abuse and perpetrator related variables that have not previously been studied as predictors of insomnia symptoms among CSA-survivors. In addition, we also aimed to include symptoms of posttraumatic stress and relational difficulties, in order to assess their ability to predict insomnia symptom trajectory. Due to a lack of empirical literature providing comparison data, no specific hypotheses were made for these variables.

2. Methods

2.1. Procedure and ethics

Data for the present study was obtained from the project *Longitudinal Investigation of Sexual Abuse* (LISA); a longitudinal survey among adult users of support centers for sexual abuse survivors in Norway. These are low-threshold service centers providing free individual consultations, support groups, information and other services to adults who have been sexually abused, and are found in every county in Norway. The project protocol was approved for enrolling only participants aged 18 years and above. Consequently, the study sample consisted exclusively of adult survivors of childhood sexual abuse.

The first data collection wave was completed in 2009. Users of the four largest support centers in Norway were invited to participate. The invitation was sent by postal mail, along with information about the study emphasizing the confidential and voluntary nature of participation, as well as a pre-paid envelope for returning the questionnaire. To enable longitudinal measurement, all participants were assigned a unique participant number that remained associated with their names. In order to ensure confidentiality of the participants, employees at the centers were the only ones who had access to the list linking the participant names to the codes. In 2011, all new users of the four centers since the first data collection wave were invited to enroll in the study in order to increase the overall sample size. Wave two and three of the survey were carried out approximately two and four years after the first data collection, respectively. The study protocol was conducted in line with the Declaration of Helsinki, and was approved by the Regional Committee for Medical and Health Research Ethics, Western Norway (approval number 264.08), the Norwegian Directory of Health, and by the Norwegian Social Science Data Services.

2.2. Respondents

See Fig. 1 for an overview of the total number of respondents in each wave. In the first data collection taking place in 2009 (wave 1), 458 people responded to the survey, representing a response rate of 32.7%. In 2011, an additional 79 new center users were enrolled, which increased the total number of wave 1 participants to 537. The response rate of this additional data collection wave is unknown due to shortcomings of registration routines. Of the 537 wave 1 participants, 263 (48.9%) responded to wave 2 of the study and 193 (73.4% of the wave 2 participants) to wave 3 of the study, which were carried out two and approximately four years after the first data collection wave, respectively. Those responding to at least one study wave were included in the present study.

2.3. Measures

2.3.1. Demographics

Demographical variables included the respondents' gender and age.

2.3.2. Characteristics of the abuse, perpetrator, and victim

Characteristics of the abuse, perpetrator and victim were assessed through a series of specific questions and check lists. These questions were not a part of a standardized instrument, but were constructed in collaboration with support center employees with a high level of expertise on the subject with the purpose of obtaining as much information as possible about circumstances related to the abuse and perpetrator. Age at abuse onset was assessed through an open-ended question (“How old were you the first time you were sexually abused?”). Dichotomous variables (1 = yes; no = 0) were created based on specific questions assessing whether or not the abuse had involved the use of *threats* by the perpetrator (e.g. of being rejected, sent away, or that oneself or a loved one would be harmed if they told anyone about the abuse), *violence* (e.g. the victim was attacked, held in place, or subjected to violence by the perpetrator), *manipulation* (e.g. manipulated by perpetrator to believe the abuse was normal, to take responsibility for the abuse, or to feel sorry for the perpetrator), *penetration* (vaginal, anal or oral penetration of penis/fingers/objects), whether or not at least one of the perpetrators was a *parent* (biological-, step-, or foster parent) or someone they had *trusted*, and whether the perpetrator was someone they also received *positive attention or care* from (e.g. perpetrator gave gifts, money, brought victim to activities/trips, gave positive care/attention). In addition, a composite score comprising other aspects of the abuse was created, reflecting how many of the following aspects they had experienced: 1) the abuse had caused serious physical injury, 2) the abuse caused diseases or infections, 3) they had reacted to the abuse with intense anxiety, helplessness or fear, 4) the abuse was particularly painful, 5) other people had been present during the abuse, 6) they had been commanded to participate in abusive acts, and 7) the abuse was video recorded/photographed. The score ranged from 0 to 7, with higher scores reflecting the number of these adverse aspects being present. All of the abovementioned variables were assessed in wave 1 of the study.

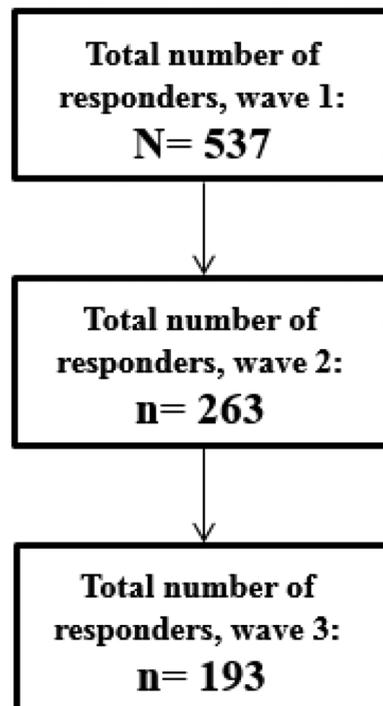


Fig. 1. Study respondents.

2.4. Outcome measure

2.4.1. Bergen Insomnia Scale (BIS)

The BIS is a six-item questionnaire assessing nocturnal and daytime symptoms of insomnia. Respondents indicate how many days per week during the past month they experienced: 1) sleep onset difficulties, 2) night-time awakenings, 3) early morning awakenings, 4) feelings of not getting sufficient rest during the night, 5) daytime tiredness/sleepiness affecting personal or occupational life, and 6) overall dissatisfaction with sleep. The BIS provides a continuous score ranging from 0 to 42, with higher scores indicating more insomnia symptoms (Pallesen et al., 2008). Cronbach's α (measuring internal reliability) for the scale in the current sample was .84 in wave 1, .90 in wave 2, and .90 in wave 3, respectively.

2.5. Mental health symptoms

2.5.1. Posttraumatic stress symptoms (PTSS)

PTSS were assessed using the Impact of Event Scale-Revised (IES-R), a 22-item questionnaire measuring core symptoms of post-traumatic stress (intrusion of trauma-related memories/emotions, avoidance of trauma-related stimuli, and hyper-arousal) the past seven days. The composite score ranges from 0 to 88, where higher scores indicate more pronounced PTSS. Moreover, a score of ≥ 33 indicates clinically significant posttraumatic stress symptomatology (Weiss & Marmar, 1997), and is the recommended cut-off score indicating probable post-traumatic stress symptoms in both international and Norwegian general population samples (Creamer, Bell, & Failla, 2003; Heir, Piatigorsky, & Weisæth, 1994; Theodorescu, Heir, Hauff, Wentzel-Larsen, & Lien, 2012). Cronbach's α for the composite score was .95 in the current study (wave 1).

2.5.2. Nightmare Distress Questionnaire (NDQ)

The NDQ comprises 13 items assessing the degree of distress experienced due to nightmares, and consequences of nightmares for daytime functioning and quality of life. Responses are scored on a 5-point scale. Total scores range from 13 to 65; with higher scores indicating higher levels of nightmare distress (Belicki, 1992). Cronbach's α was .92 in the current study (wave 1).

2.6. Social and relational factors

2.6.1. The multidimensional scale of perceived social support (MSPSS)

The MSPSS comprises 12 items assessing perceived social support from family, friends, and significant others. The MSPSS provides a continuous score ranging from 12 to 84, with higher scores indicating higher levels of perceived social support. The scale has shown good internal and test-retest reliabilities, as well as moderate construct validity (Zimet, Dahlem, Zimet & Farley, 1988; Zimet, Powell, Farley, Werkman & Berkoff, 1990). Cronbach's α was .90 in the current study (wave 1).

2.6.2. Relational difficulties

A five-item scale constructed by the authors for the purpose of this study was used to assess the respondent's subjectively experienced relational difficulties (e.g. difficulties engaging in close relationships, and with trusting or attaching to others). Response categories were "strongly disagree", "disagree", "neither disagree nor agree", "agree", and "strongly agree" (coded from 1 to 5). Possible scores range from 5 to 25, with higher scores reflecting more subjectively experienced relational difficulties. Cronbach's α for the scale was .75 (wave 1).

2.7. Statistical analyses

2.7.1. Descriptive statistics

Descriptive statistics were calculated for all the variables included in the study.

2.7.2. Latent class growth analyses (LCGA)

LCGA was used to identify different trajectories of insomnia symptoms across the three time-points. LCGA is a person-centered approach that assigns individuals to latent classes in a probabilistically manner (Berlin, Parra, & Williams, 2014). By employing LCGA, repeated measurements of observed variables are used as manifest indicators of individual trajectories, commonly represented by the latent variables intercept and slope (Berlin et al., 2014). For the purposes of this study, LCGA was used to identify the optimal number of trajectories of insomnia symptoms, as well as for assessing the stability or change for each identified trajectory. Five models were estimated, ranging from one class to five classes. Each model was specified with factor loadings corresponding to distance in time from baseline (specified as '0') to the second follow-up (specified as '2') (Jung & Wickrama, 2008). For each of the five classes, model fit was evaluated using the comparative fit indices Akaike (AIC) and Bayesian (BIC) Information Criteria, as well as Vuon-Lo-Mendell-Rubin likelihood ratio test (VLMR-LR), Lo-Mendell-Rubin Adjusted likelihood ratio test (LMRA-LR), parametric bootstrapped likelihood ratio test (Bootstrap-LR), and entropy values. Starting with the one-class model, iterative comparisons of AIC- and BIC-values between the different models were made. Lower AIC- and BIC-values indicates a better fit between the proposed model and the actual data. A non-significant likelihood ratio statistic indicates that a model with one less class is preferable (principle of simplicity). In order to assess the robustness of the likelihood ratio test statistics, at least five models were computed. Entropy values were also contrasted. Values approaching 1 reflect a higher classification accuracy (Jung & Wickrama, 2008). Conversely, an

entropy value approaching zero is a cause of concern, as it implies that posterior probabilities do not separate well between trajectories. After the iterative comparisons, the models were visually inspected, and the retained model was chosen based on model fit, coherence, interpretability and parsimony. All LCGAs were computed using Mplus, version 8 (Muthén & Muthén, 2017) and the full information maximum likelihood estimator (FIML) for handling of missing data on the Bergen Insomnia Scale was used.

2.7.3. Associations between predictor variables and trajectory belongingness

The native R3STEP-procedure (available in Mplus) was employed to assess the associations between trajectory belongingness and the predictor variables gender, age, the abuse and perpetrator characteristics, and PTSS. The R3STEP-procedure enables independent evaluations of the relationship between the included predictor variables and the different trajectories (Asparouhov & Muthén, 2014), represented as multinomial logistic regression coefficients. Due to missing information on some of the included variables (ranging from $n = 1$ (0.2%) to $n = 71$ (13.3%)), the native Mplus missing data imputation procedure was employed, creating 100 new datasets, for the R3STEP-analyses. All variables were entered separately, and the crude coefficients and exponentiated coefficients were estimated using the imputed data.

2.7.4. Associations between trajectories and social and relational factors

The automatic Bolck-Croon-Hagenaars-procedure (BCH) implemented in Mplus was used to estimate crude associations between social and relational factors and insomnia symptom trajectories. The R3STEP-procedure was used to estimate the associations adjusted for age, gender and abuse-, victim-, and perpetrator related aspects (age at first abusive incident, whether the abuse involved penetration, threats, manipulation, physical violence, or positive attention by the perpetrator, and whether the perpetrator was a parent or trusted person)

2.7.5. Analyses of loss to follow-up

In order to assess the potential mechanisms related to loss to follow-up, additional analyses were conducted comparing those who participated in one, two and three study waves, respectively, on the main variables included in the present study.

3. Results

3.1. Current study sample

A total of 533 individuals (94.9% women) responded to at least one study wave. Descriptive statistics of the sample and all study variables are presented in Table 1.

Table 1
Descriptive statistics the main study variables.

Continuous variables	Mean	SD	Range	95% CI	N
Age at participation (baseline)	39.2	12.1	12-73	38.1 – 40.3	494
Age at first abusive incident	6.5	3.9	0-24	6.2 – 6.9	513
Perceived social support (MSPSS; baseline)	52.6	15.0	12-84	51.3 – 53.9	511
Relational difficulties (baseline)	16.1	4.2	5-25	15.8 – 16.5	529
Nightmare Distress (NDQ; baseline)	34.3	10.6	13-60	33.4 – 35.3	495
Bergen Insomnia Scale (BIS; baseline)	22.5	10.7	0-42	21.6 – 23.4	531
BIS score, follow-up t1	21.5	10.8	0-42	20.2 – 22.8	254
BIS score, follow-up t2	18.9	11.1	0-42	17.4 – 20.5	188
Categorical variables	Proportion			N	
Gender (% female)	94.9%			532	
Penetrative abuse (% yes)	76.8%			534	
Manipulated by perpetrator (% yes)	75.1%			534	
Perpetrator was a trusted person (% yes)	71.2%			534	
Positive attention/care from perpetrator (% yes)	59.6%			534	
Abuse involved physical force/violence (% yes)	48.5%			534	
Threatened by perpetrator (% yes)	39.0%			534	
Perpetrator biological parent (% yes)	37.8%			534	
PTSS (IES-R score ≥ 33 , baseline) (% yes)*	73.2%			462	
Disability pension (% yes)	44.2%			527	
Ordinal variable	Mean	Med	Range	IQR	N
Other abuse aspects (# of affirmative responses)	1.8	2	0-6	1-2	534

SD: Standard deviation. 95% CI: 95% Confidence Interval. Med: Median. IQR; Interquartile Range. MSPSS: Multidimensional Scale of Perceived Social Support. NDQ: Nightmare Distress Questionnaire. IES-R: Impact of Event Scale Revised. *Score ≥ 33 indicates probable clinically significant posttraumatic stress symptoms (PTSS).

3.2. Insomnia symptom trajectories

Based on the combined assessment of model fit indices, coherence, interpretability and parsimony, a three-class model was retained for further analyses. The three-class model had a lower comparative fit (AIC, BIC) vis-à-vis a one- or two-class model, and also the highest entropy value (Table 2). Also, all the likelihood ratio test statistics indicated that a three-class model possessed a better fit to the actual data than a two-class model. Although a four-class model to some degree was supported by the fit indices, with slightly lower comparative fit statistics, the entropy value of this model was substantially poorer, and two of three likelihood ratio tests were non-significant. A five-class model was not supported by the data. The three trajectories identified in the 3-class model were also interpretable and meaningful (Fig. 2), with one *low and stable* trajectory (Class 1; 27.9%), one *intermediate and stable* trajectory (Class 2; 41.5%), and one *high and decreasing* trajectory (Class 3; 30.6%). The slope of the two former trajectories were non-significant (p -values 0.601 and 0.086, respectively), but significant for the latter trajectory ($p = 0.003$). As seen in Fig. 2, there was no crossing of the slope lines between the three trajectories at any of the measurement time points, with scores of the “*high and decreasing*” trajectory being significantly higher than the “*intermediate and stable*” trajectory, and the “*intermediate and stable*” trajectory being significantly higher than the “*low and stable*” trajectory, at all measurement time points.

3.2.1. Post-hoc analyses

After seeing the large differences in insomnia symptoms between the three different trajectories, we wanted to explore whether the trajectories differed on other variables related to sleep as well as in terms of functioning. Post-hoc analyses were therefore carried out in order to examine crude associations between the identified trajectories and i) nightmare related distress (Nightmare Distress Questionnaire (NDQ); Belicki, 1992) using Mplus’ BCH-procedure, and ii) work functioning (defined as whether or not the respondents were recipients of work-related disability pension) using Mplus’ DCAT-procedure for distal categorical outcomes. The R3STEP-procedure was used to estimate the associations adjusted for age, gender and the abuse-, victim-, and perpetrator related variables.

With regards to nightmare related distress, the analyses revealed a higher score on the NDQ in the *high and decreasing* trajectory (mean 42.3) compared to the *intermediate and stable* trajectory (mean 33.8, $p < 0.001$) and the *low and stable* trajectory (mean 26.0, $p < 0.001$), respectively. The *low and stable* trajectory also scored significantly lower on the NDQ compared to the *intermediate and stable* trajectory ($p < 0.001$). The same pattern was observed even after adjusting for age, gender and the abuse-, victim-, and perpetrator related variables (Table 4).

Work disability was reported by 59.3% in the *high and decreasing* trajectory, compared to 30.6% in the *low and stable* trajectory ($p < 0.001$). The *high and decreasing* trajectory also reported a higher proportion of work disability compared to the *intermediate and stable* trajectory (41.9%) ($p = 0.007$). No statistical difference was observed between the *low and stable* and the *intermediate and stable* trajectory ($p = 0.091$). After adjusting for age, gender and the abuse-, victim-, and perpetrator related variables, no statistical difference was observed between the high and decreasing trajectory and the intermediate and stable trajectory in relation to work disability (Table 4).

3.3. Predictor variables and trajectory belongingness

Results are displayed in Table 3. Gender and age were not associated with the three trajectories. Age at abuse onset was negatively associated with belonging to the *high and decreasing* trajectory compared to the *low and stable* reference trajectory (exponentiated coefficient (EC): 0.93, $p = 0.026$), while penetrative abuse (EC: 2.36, $p = 0.005$) and threats (EC: 3.06, $p < 0.001$) was positively associated with belonging to the *high and decreasing* trajectory. There was also a significant difference between belonging to the *high and decreasing* trajectory compared to the *intermediate and stable* trajectory for threats (EC: 2.45, $p = 0.001$). Abuse that involved physical violence and the composite variable comprising other abuse and perpetrator characteristics were positively associated with belonging to the *intermediate and stable* (EC: 2.08, $p = 0.013$ and EC: 1.69 $p = 0.007$, respectively) and the *high and decreasing* trajectory (EC: 3.29 $p < 0.001$ and EC: 2.55, $p < 0.001$, respectively), compared to the *low and stable* trajectory. There was a positive association between the composite variable comprising other abuse and perpetrator aspects and belonging to the *high and decreasing* trajectory as compared to the *intermediate and stable* trajectory (EC: 1.50, $p < 0.001$). Finally, scoring equal to or above the

Table 2

Fit indices for the Bergen Insomnia Scale, latent class growth curves (N = 533).

	AIC	BIC	Sample-size adjusted BIC	Entropy	VLMR-LR	LMRA-LR	Bootstrap-LR
1 Class	7398.818	7420.211	7404.339	NA	NA	NA	NA
2 Classes	7210.525	7244.753	7219.358	0.639	$p < 0.001$	$p < 0.001$	$p < 0.001$
3 Classes	7164.718	7211.781	7176.864	0.707	$p = 0.013$	$p = 0.015$	$p < 0.001$
4 Classes	7149.237	7209.137	7164.696	0.584	$p = 0.097$	$p = 0.106$	$p < 0.001$
5 Classes	7150.025	7222.760	7168.796	0.549	$p = 0.396$	$p = 0.408$	$p = 0.429$

AIC: Akaike information criteria; BIC: Bayesian information criteria; VLMR-LR: Vuong-Lo-Mendell-Rubin likelihood ratio test; LMRA-LR: Lo-Mendell-Rubin Adjusted likelihood ratio test; Bootstrap-LR: Parametric bootstrapped likelihood ratio test.

Bold indicates the model chosen for further analyses.

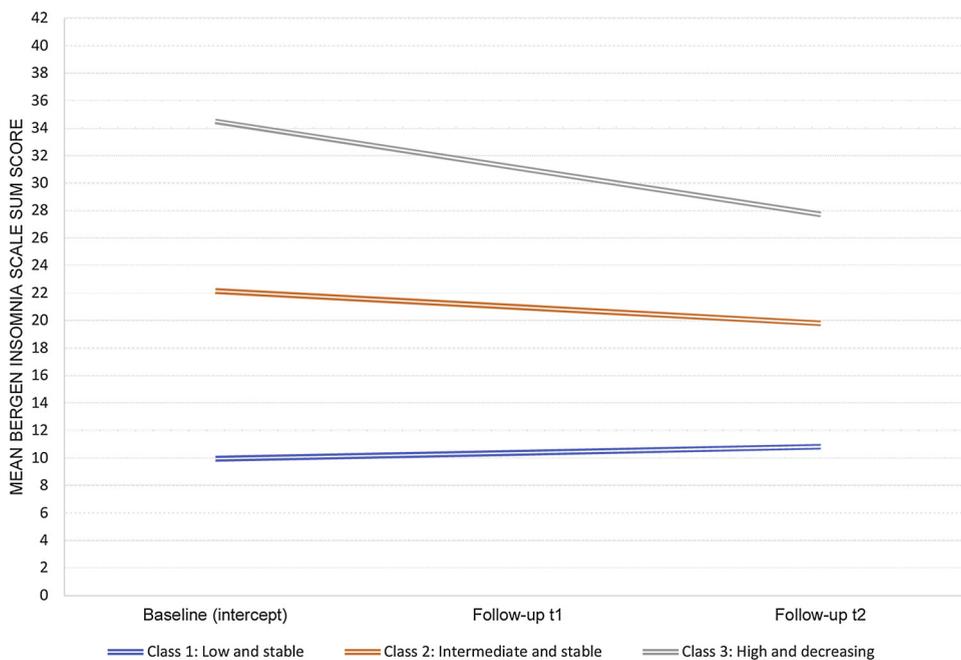


Fig. 2. Estimated mean BIS sum scores across time for three latent classes.

Table 3

Associations between sleep problems trajectories and gender, age and abuse aspects (N = 533). Crude multinomial logistic regressions.

Covariate	Class 1 <i>Low and stable</i>	Class 2 <i>Intermediate and stable</i>	Class 3 <i>High and decreasing</i>
Age at participation	ref	-0.01 (0.99)	0.01 (1.00)
Age at first abusive incident	ref	-0.02 (0.98)	-0.08 (0.93)
Gender	ref	-0.29 (0.75)	0.26 (1.30)
Penetrative abuse	ref	0.61 (1.85)	0.86 (2.36)
Perpetrator was a trusted person	ref	-0.02 (0.98)	-0.23 (0.80)
Manipulated by perpetrator	ref	0.04 (1.04)	0.26 (1.30)
Positive attention/care from perpetrator	ref	-0.08 (0.92)	-0.18 (0.84)
Abuse involved physical force/violence	ref	0.73 (2.08)	1.19 (3.29)
Threatened by perpetrator	ref	0.22 (1.25)	1.12 (3.06)
Perpetrator biological parent	ref	0.01 (1.01)	0.07 (1.07)
Other abuse aspects	ref	0.53 (1.69)	0.94 (2.55)

Exponentiated coefficients in parentheses.

Bold indicates significant associations (p < 0.05).

clinical cutoff of 33 on the IES-R scale measuring PTSS was positively associated with belonging to the *intermediate and stable* (EC: 3.07, p = 0.001) and the *high and decreasing* trajectory (EC: 12.17 p < 0.001, compared to the *low and stable* trajectory). Those in the *high and decreasing* trajectory were also more likely to score above the cutoff compared to the *intermediate and stable* group (EC: 3.97 p = 0.003).

3.4. Perceived social support and relational difficulties

With regards to perceived social support, the *high and decreasing* trajectory had lower scores on this variable (mean 45.6) compared to the *low and stable* trajectory (mean 57.0, p < 0.001) and the *intermediate and stable* trajectory (mean 54.6, p < 0.001). There was no difference in perceived social support between the two latter trajectories (p = 0.230). Adjusting for age, gender and the abuse-, victim-, and perpetrator related variables did not change the observed associations between perceived social support and trajectories (Table 4). Similarly, self-reported relational difficulties were highest in the *high and decreasing* trajectory (mean 17.7) compared to the *low and stable* (mean 14.7, p < 0.001) and the *intermediate and stable* (mean 15.9, p = 0.001) trajectories. Self-reported relational difficulties were also higher in the *intermediate and stable* trajectory compared to the *low and stable* trajectory (p = 0.038). No other significant associations were found. After adjusting for age, gender and the abuse-, victim-, and perpetrator related variables, there were no statistical difference between the *low and stable* trajectory and the *intermediate and stable* trajectory (Table 4).

Table 4

Associations between sleep problem trajectories and proximal potentially modifiable factors. Crude multinomial logistic regression, and adjusted for gender, age and abuse aspects.

Covariate	Class 1 <i>Low and stable</i>	Class 2 <i>Intermediate and stable</i>	Class 3 <i>High and decreasing</i>
Crude			
MSPSS	ref	−0.012 (0.99)	−0.053 (0.95)
Relational difficulties (baseline)	ref	0.077 (1.08)	0.179 (1.20)
Nightmare Distress (NDQ; baseline)	ref	0.105 (1.11)	0.218 (1.24)
PTSS (IES-R score ≥ 33, baseline)	ref	1.121 (3.07)	2.499 (12.17)
Disability pension	ref	0.468 (1.60)	1.200 (3.32)
Adjusted			
MSPSS	ref	0.011 (1.01)	−0.051 (0.95)
Relational difficulties (baseline)	ref	0.059 (1.06)	0.170 (1.19)
Nightmare Distress (NDQ; baseline)	ref	0.100 (1.11)	0.212 (1.24)
PTSS (IES-R score ≥ 33, baseline)	ref	1.007 (2.74)	2.279 (9.77)
Disability pension	ref	0.367 (1.44)	0.805 (2.24)

Exponentiated coefficients in parentheses.

Bold indicates significant associations ($p < 0.05$).

4. Discussion

4.1. Summary of findings

In this first study of its kind, we examined longitudinal insomnia symptom trajectories, as well as predictors and correlates of trajectory belongingness, in a sample of 533, mainly female CSA-survivors recruited from support centers for sexual abuse survivors in Norway. Latent class growth analyses provided the best overall fit for a model comprising three insomnia symptom trajectories: One characterized by high insomnia symptom scores decreasing minimally over the four year study period (*high and decreasing*, 30.6% of the sample), one characterized by stable intermediate insomnia symptom scores (*intermediate and stable*, 41.5% of the sample), and one characterized by stable low insomnia symptoms (*low and stable*, 27.9% of the sample). A lower age at abuse onset, abuse involving penetration, threats, physical violence, as well as a higher score on a composite variable comprising seven other abuse and perpetrator characteristics, were associated with a higher likelihood for belonging to the *high and decreasing* trajectory compared to the *low and stable* trajectory. Abuse involving physical violence was also associated with an increased likelihood of belonging to the *intermediate and stable* trajectory compared to the *low and stable* trajectory. Finally, participants belonging to the *high and decreasing* trajectory reported lower levels of perceived social support and higher levels of subjectively experienced relational difficulties compared to those belonging to the two other trajectories. Lower levels of perceived social support and more relational difficulties were also found in the *intermediate and stable* trajectory compared to the *low and stable* trajectory. Individuals in the *high and decreasing* trajectory also reported more nightmare-related distress, in addition to higher rates of receiving work related disability pension compared to the other two trajectories, indicating lower levels of work functioning in this trajectory.

4.2. Proportion of sample displaying insomnia symptoms

Our findings show that a substantial proportion of CSA-survivors display insomnia symptoms in adulthood, as demonstrated by the large proportion of participants with high insomnia symptom scores (30.6%) and intermediate symptom scores (41.5%) across the four year study period. These findings are in line with previous studies reporting a high prevalence of insomnia symptoms among CSA-survivors (Kajeeepeta et al., 2015; Lind et al., 2016; Steine, Harvey et al., 2012), but also add to the existing literature by showing that distinct longitudinal insomnia symptom trajectories can be identified within a sample of adult CSA-survivors, suggesting large individual differences in insomnia symptomatology following CSA.

The identified trajectories were clinically relevant, and the intermediate- and high-symptom trajectories (constituting 72.1% of the sample) displayed scores on the BIS that were either comparable to or higher, respectively, than BIS-scores found in samples of insomnia patients (Hagatun et al., 2017; Pallesen et al., 2008), indicating probable clinically significant insomnia among those belonging to these trajectories. In light of findings from longitudinal community and population based studies showing a high degree of stability of insomnia symptoms among adults across time (Morin et al., 2009; Pillai, Roth, & Drake, 2015), we regard it as likely that the identified trajectories represent relatively stable symptom subgroups, especially since a relative stability of symptom levels was a characteristic of the identified trajectories.

Unlike the two other trajectories, the *high and decreasing* trajectory showed a decrease of insomnia symptoms over the four year study period. The decrease was minimal, and may reflect a regression towards the mean in this very high-symptom trajectory, highlighting the need for replication of our findings in other samples.

4.3. Abuse and perpetrator characteristics

The finding that abuse involving penetration, threats and physical violence was associated with belonging to the most severe insomnia symptom trajectory, is in line with previous studies linking these abuse-related aspects to more severe symptoms in general and to more insomnia symptoms specifically (Heath et al., 1996; Lind et al., 2016; Steine, Krystal et al., 2012), and thus lends further support to these aspects comprising risk factors for more severe insomnia symptoms among CSA-survivors. In addition, lower age at abuse onset was associated with belonging to the most severe insomnia symptom trajectory in the present study, as was a higher score on the composite variable measuring other abuse-related circumstances (that the abuse had caused physical injury/disease/infection or was particularly painful, the victim reacted with intense anxiety/helplessness/fear, the victim was commanded to participate in abusive acts, other people were present during the abuse, or the abuse was video recorded/photographed), indicating that these aspects may also be especially important contributors to long-term insomnia symptoms among adult CSA-survivors.

Contrary to studies in other symptom domains reporting more severe symptoms when the victim had a close relation to the perpetrator (Kendall-Tackett, Williams, & Finkelhor, 1993; Wolfe, Sas, & Wekerle, 1994), this relational aspect was not predictive of insomnia trajectory in the present study. This discrepancy could be due to differences in sample characteristics. Specifically, previous studies reporting this association were conducted in samples of children (Kendall-Tackett et al., 1993; Wolfe et al., 1994), whereas our sample comprised adults aged 18 years or older, raising the possibility that effects of some abuse and perpetrator characteristics on symptom severity may be developmentally specific and hence not generalizable across different age groups. However, the inconsistency in the associations of abuse and perpetrator characteristics with symptom severity could also vary across different symptom domains, indicating that a general risk factor model across different symptom outcomes may not be feasible. The present study doesn't allow for any conclusions regarding this issue, highlighting that further studies and subsequent reviews (e.g. meta-analyses) of the overall literature are necessary. The same line of reasoning can be applied to the other abuse- and perpetrator related aspects that were not predictive of insomnia trajectory in the present study, including the perpetrator having been a trusted person, the use of manipulation by the perpetrator to enable the abuse, and having received positive attention or care from the perpetrator.

4.4. Perceived social support and relational problems

The association of lower perceived social support levels with the more severe insomnia symptom trajectories is in line with a large existing literature linking lower social support levels to higher symptom levels among CSA-survivors (Lueger-Schuster et al., 2015; Hyman, Gold, & Cott, 2003; Tremblay, Hébert, & Piché, 1999; Ullman, 1999), and adds to the literature by showing that this pattern could also be observed with regards to insomnia symptoms, consistent with our hypothesis. Although we cannot determine the exact nature of this association in our sample, several interpretations are plausible.

Firstly, less perceived social support could result in more severe insomnia symptoms, since those perceiving less social support are likely to experience lower levels of both direct and stress-buffering benefits of social support (Aydin, Akbas, Turla, & Dundar, 2016; Cohen, 2004; Uchino, 2006; Umberson & Montez, 2010). This interpretation is supported by studies showing that CSA-victims with lower social support levels display higher symptom levels across multiple symptom domains, highlighting the stress-buffering potential of social support among CSA-survivors (Bal, De Bourdeaudhuij, Crombez, & Van Oost, 2005; Kaufman et al., 2004).

Secondly, a more severe symptomatology may interfere with social relationships to a larger extent compared to a less severe symptomatology, leading to more relational problems or reduced social support over time. Indeed, studies show that symptom severity predicts the degree of psychosocial impairment among survivors of childhood sexual and physical abuse (Cloitre, Miranda, Stovall-McClough, & Han, 2005).

Thirdly, longitudinal studies of survivors of other traumatic events indicate that both aforementioned processes may operate at different time points. Specifically, lower social support levels have been found to predict more severe trauma-related symptoms short-term, whereas more severe trauma-related symptoms have been found to predict lower social support long-term (Kaniasty & Norris, 2008), highlighting the complexity of the longitudinal association between social support and symptom levels.

Yet another potential explanation is that being victimized by CSA may compromise the development of the capacity to build or utilize supportive relationships, and thus that different perceived social support levels reflect individual differences in such capabilities. In support of this interpretation, several representative population studies have shown that CSA is a significant predictor of smaller network size and lower levels of emotional support from friends, family or spouses later in life (Golding, Wilsnack, & Cooper, 2002), indicating that experiencing CSA may affect the person's ability to establish, maintain or utilize supportive relationships. Thus, CSA may be a distal risk factor that compromises the development of proximal protective factors such as social support, with subsequent negative consequences for health and stress resilience later in life.

4.5. Association of PTSS with insomnia symptom trajectories

Our finding of increased rates of individuals scoring above the clinical PTSS cutoff in the *high and decreasing* and *intermediate and stable* trajectories compared to the *low and stable* trajectory, suggests more hyperarousal among individuals in the former trajectories, which would be in line with a hyperarousal explanatory framework of insomnia. However, the design of the present study does not allow any inferences about the mechanisms underlying the association between CSA and insomnia in adulthood, leaving this an important topic for future research.

4.6. Clinical implications

Overall, the high proportion of CSA-survivors displaying insomnia calls for the assessment and treatment competence of insomnia symptoms by clinicians working with CSA-survivors, especially when encountering those victimized by severe abuse starting early in life, given the apparent contribution of these factors to more severe long-term insomnia symptoms. The importance of treating insomnia in this group is highlighted by the well-established negative consequences of insomnia in the form of increased risk for subsequent mental health problems, social and occupational dysfunction, impaired quality of life, and increased health care costs in general (Cappuccio, D'Elia, Strazzullo, & Miller, 2010; Edinger & Means, 2005; Pigeon et al., 2012; Roth & Ancoli-Israel, 1999), in addition to an increased revictimization risk among CSA-survivors specifically (Noll, Trickett, Susman, & Putman, 2006). While sleep disturbances are also among the core symptoms of other mental health disorders that are found at higher rates among CSA-survivors, such as PTSD and depression (Chen et al., 2010; Fergusson et al., 2013; Paolucci, Genius, & Violato, 2001), the importance of targeting insomnia symptoms specifically rather than treating them as secondary to these conditions are highlighted by studies showing that insomnia symptoms tend to persist following successful treatment of PTSD (Zayfert & DeViva, 2004) and depression (Pigeon et al., 2009), calling for interventions targeting insomnia symptoms specifically in this group. Moreover, the transdiagnostic nature of sleep disturbances makes improving sleep an important intervention target across multiple diagnostic categories (Dolsen et al., 2014; Harvey, 2008; Harvey et al., 2011). Treating sleep disturbances may also directly help alleviate symptoms of co-occurring psychiatric problems, since sleep disturbances are known to contribute to the maintenance of psychiatric disorders (Krakow et al., 2001). Also, successful treatment of sleep disturbances may provide the survivor with the energy needed to work therapeutically with other challenging symptoms. While it is beyond the scope of the present study to describe the process of diagnosing and treating insomnia, multiple excellent clinical practice guidelines comprising both non-pharmacological and pharmacological treatment recommendations can be found elsewhere (Qaseem, Kansagara, Forcica, Cooke, & Denberg, 2016; Riemann et al., 2017; Sateia, Buysse, Krystal, Neubauer, & Heald, 2017; Schutte-Rodin, Broch, Buysse, Dorsey, & Sateia, 2008).

The broader evidence linking social support to less insomnia might implicate perceived social support as a potentially modifiable factor with relevance for insomnia. Interventions aimed at increasing social support may take the form of increasing a patient's ability to build supportive relationships if such are lacking (e.g. skills training to increase social competence), or the ability to elicit or utilize social support if healthy relationships are already present in the person's life. (Allen, 2001). However, more research is needed on the association between perceived social support and insomnia symptom severity before any interventions targeting social support can be recommended in the context of treating insomnia.

4.7. Limitations, strengths and future directions

A critical evaluation of the limitations of the present study is warranted. First, the sample consisted of users of support centers for sexual abuse survivors, who may not be representative of the population of CSA-survivors in general, which may limit the generalizability of our findings to other populations of CSA-survivors. Secondly, the majority of the sample (94.9%) were women, introducing uncertainty regarding the generalizability of our findings to male CSA-survivors. While gender differences in outcomes among CSA-survivors have been reported in specific populations (e.g., in the risk for offensive behaviors in samples of juvenile criminals; Asscher, Van der Put, & Stams, 2015), no significant gender differences have been found in the risk for symptoms for male versus female CSA-survivors in large population studies (Dube et al., 2005) and quantitative literature reviews (Tolin & Foa, 2006). These studies did not examine sleep disturbances specifically however, highlighting the need to replicate our findings in samples comprising a higher proportion of male CSA-survivors. Thirdly, the response rate in our study was relatively low (32.7% in the first study wave), which may further limit the generalizability of our findings. Fourthly, insomnia symptoms were exclusively based on self-report, making the clinical validity of the reported insomnia symptoms uncertain. In light of these limitations, our findings should be replicated using representative samples of CSA-survivors and clinically validated insomnia measures. Fifthly, as we had not collected data related to stressful events occurring in adulthood this precluded us from adjusting for more recent events that might have contributed to the insomnia symptoms in the statistical analyses. However, a previous study reported an association between early life stress and adult sleep problems that remained significant even after controlling for both recent life stressors and current psychopathology (depression and anxiety symptoms), indicating that childhood CSA contributes independently to the risk of sleep disturbances in adulthood (Schafer & Bader 2013). Still, the sparse empirical literature on this topic highlights the need for future studies to overcome this limitation by measuring and controlling for more recent life stressors. A sixth limitation pertains to how missing data were handled in the statistical analyses. In order to retain the maximum level of information, we used the native FIML-approach for handling of such data, which ensured that all participants with at least one valid sum score on the Bergen Insomnia Scale were used to inform the estimation of the sleep problem trajectories. However, a post-hoc sensitivity analyses including only those with valid composite BIS scores on at least two time-points ($n = 303$), yielded similar trajectories and similar associations with the abuse-related aspects (data not shown), adding support to the validity of the reported findings. Additional limitations include the use of an unstandardized measure of relation problems and a lack of control for variables that may have affected sleep, such as treatment or medication use. This highlights the need to replicate our findings in studies using validated measures of relational problems as well as studies controlling for treatment and medication use. There is also a need for treatment studies assessing whether insomnia treatment alters symptom trajectory belongingness, as has been reported following treatment of other symptoms groups (Gueorguieva et al., 2007; Gueorguieva, Mallinckrodt, & Krystal, 2011). Finally, due to the age range of the recruited sample, the insomnia symptom trajectories reflect insomnia symptoms over a four year period in adulthood only, and we have no information regarding the participants' insomnia symptoms during childhood or adolescence. Due to the lack of such data, no inferences can be

made regarding the potential stability or change of the insomnia symptoms from childhood to adulthood based on our study. In order to elucidate the stability or change of insomnia symptom trajectories over time, longitudinal studies of CSA-survivors from childhood to adulthood are necessary. Strengths of the present study include the relatively large sample of CSA-survivors and the longitudinal design enabling the symptom trajectory analyses, representing a novel contribution to the field.

5. Conclusions

In conclusion, the present study identified three distinct insomnia symptom trajectories in a sample of adult, mainly female CSA-survivors; one low-, one intermediate- and one high and minimally decreasing symptom profile. Increased likelihood of belonging to the high symptom profile was found for those with a lower age at abuse onset, those who had experienced abuse involving threats, physical force/violence, penetration, and those with higher scores on a composite variable comprising multiple other abuse and perpetrator aspects, indicating that these factors can bring about more severe long-term insomnia symptoms in this group. Moreover, people in the higher symptoms trajectories reported lower levels of perceived social support and more relational problems, representing potential avenues for clinical interventions.

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