Childhood maltreatment, vulnerability characteristics and adult incident common mental disorders: 3-year longitudinal data among > 10,000 adults in the general population

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A B S T R A C T

Childhood maltreatment (CM) is a strong predictor of incident (first-onset and recurrent) mental disorders in adulthood. However, less is known about underlying mechanisms and moderators of these associations. This study examines to what extent vulnerability characteristics (low social support, negative life events, parental psychopathology, neuroticism, history and comorbidity of mental and physical health) contribute to the impact of CM on adult psychopathology.

Data from two general population cohorts – the first and second Netherlands Mental Health Survey and Incidence Studies – were combined into one dataset (N = 10,065). CM (emotional, psychological, physical or sexual abuse before the age of 16) and vulnerability characteristics were assessed with a structured face-to-face interview. First-onset and recurrent mental (mood, anxiety, substance use) disorders were assessed using the Composite International Diagnostic Interview.

CM doubled the risk of developing a first-onset or recurrent mental disorder at three-year follow-up (OR = 2.08). CM was not only directly connected to incident mental disorders, but also indirectly through vulnerability characteristics. Several vulnerabilities, in particular low social support, parental psychopathology, prior mental disorders and neuroticism, moderated the relationship between CM and adult mental disorders, indicating that these vulnerability factors had a greater effect on incident mental disorders among people with childhood abuse.

As not all adults with a history of CM develop mental disorders, these mediating and moderating risk factors might help identify adults with a history of maltreatment who could benefit from preventive interventions.

1. Introduction

Numerous studies have identified the harmful effects that adverse childhood experiences have on mental health throughout the life-course (Hughes et al., 2017). Childhood adversities, like maltreatment, parental maladjustment, and interpersonal loss have been associated with adult mood, anxiety and substance use disorders, with little variation in these associations across disorders (Green et al., 2010; Kessler et al., 1997; Teicher and Samson, 2013). Despite little specificity having been found for particular childhood adversities with particular mental disorders, of all adversity types CM was strongest associated with disorder onset (Green et al., 2010; Hovens et al., 2015; Kessler et al., 2010). Simulations based on 21 mental health surveys found that childhood

adversities were associated with approximately 25% of all adult-onset disorders (Kessler et al., 2010). These long lasting effects on mental health imply the existence of mediating pathways linking early adversities to adult mental disorders.

Several studies have investigated this issue to better understand the mechanisms underlying this association. Studying the potential mediators and moderators of the relationship between childhood adversities and adult mental disorders is important as it could lead to the identification of new targets for prevention and treatment of adults with a history of childhood adversity. However, the existing studies in this field are limited as they often 1) focus on a single mediator or moderator, in particular social support and stressful life events, and not on a variety of factors, 2) assess symptoms, in particular depressive

symptoms (Korkeila et al., 2005; LaNoue et al., 2012; Salazar et al., 2011; Sheikh, 2018; Sousa et al., 2017; Sperry and Spatz Widom, 2013; Von Cheong et al., 2017), instead of a wider variety of mental disorders, 3) are cross-sectional and as a consequence cannot identify the temporal relationship between risk factors and outcomes (Li et al., 2016), and 4) are based on a selective sample of abused youth (Salazar et al., 2011; Sperry and Spatz Widom, 2013), women (Vranceanu et al., 2007), families (Herrenkohl et al., 2016), students (Lagdon et al., 2018), workers (Bandoli et al., 2017; Korkeila et al., 2005), patients (Kok et al., 2014; Schwandt et al., 2013) or a convenience sample (Ono et al., 2017; Torgerson et al., 2018) as opposed to a representative general population sample. Despite these limitations, findings indicate a strong case for partial mediation of the relationship between childhood adversity and adult mental health by low social support (Herrenkohl et al., 2016; Hill et al., 2001; Jones et al., 2018; Lagdon et al., 2018; Oshio et al., 2013; Salazar et al., 2011; Sheikh, 2018; Sperry and Spatz Widom, 2013; Shevlin et al., 2015; Torgerson et al., 2018) and to a lesser extent by stressful life events (mediation found by Korkeila et al., 2005; LaNoue et al., 2012; no mediation found by Kok et al., 2014; Sousa et al., 2017). The findings are less straightforward for moderating factors. In studies that found a moderating effect of stressful life events, it was most evident among individuals with three or more childhood adversities (McLaughlin et al., 2010), among women (Korkeila et al., 2005), at high levels of stress (Bandoli et al., 2017) or in the minority of tested interaction effects (Colman et al., 2013; Myers et al., 2014). In studies that found a buffering effect of high social support on the association between CM and mental ill health, this was stronger for those experiencing fewer types of maltreatment (Salazar et al., 2011), for those with no childhood sexual abuse (Hill et al., 2001), and for males (Sperry and Spatz Widom, 2013). In three other studies no moderating effect of social support was found (Herrenkohl et al., 2016; Oshio et al., 2013; Von Cheong et al., 2017). Fewer studies focused on the role of other vulnerability factors like prior mental health (Hovens et al., 2012; Brensilver et al., 2011), personality traits (Hovens et al., 2016; Lee and Song, 2017; Okubo et al., 2017), resilience (Poole et al., 2017), attachment styles (Bifulco et al., 2006) and parental psychopathology (Fenton et al., 2013).

Identifying risk and protective factors in adulthood (e.g., adult stressors, personality, social support) that contribute to the impact of childhood adversities on adult psychopathology is an overlooked research area in population studies (Green et al., 2010; McLaughlin, 2016). This paper attempts to fill this gap by using data from two population cohorts – the first and second Netherlands Mental Health Survey and Incidence Studies (NEMESIS and NEMESIS-2). By studying the associations between CM and incident (first-onset or recurrent) common mental disorders in the adult general population, and to what extent a larger set of vulnerability characteristics mediate or moderate the relationship between CM and adult mental disorders, we tried to overcome some major limitations of previous studies.

2. Material and methods

NEMESIS and NEMESIS-2 are two separate psychiatric epidemiological cohort studies of the Dutch general population aged 18–64 years. Both are based on a multistage, stratified random sampling of households, with one respondent randomly selected in each household. The interviews were laptop computer-assisted and almost all were held at the respondent's home.

In the first wave of NEMESIS, performed in 1996, 7,076 persons were interviewed (response rate 69.7%). In the first wave of NEMESIS-2, performed from November 2007 to July 2009, 6,646 persons were interviewed (response rate 65.1%). Both samples were nationally representative, although younger subjects were somewhat underrepresented (Bijl et al., 1998; De Graaf et al., 2010).

All respondents were approached for follow-up. In NEMESIS, one and three years after baseline; in NEMESIS-2, three and six years after

baseline. For the present study, all waves from NEMESIS and the first two waves from NEMESIS-2 were used, both covering a three-year period. In NEMESIS, three years after baseline 4,796 persons could be interviewed again (response rate 67.8%, with those deceased *included* in the nonresponse rate); and in NEMESIS-2, 5,303 persons (79.8%). Attrition rate at three-year follow-up was in both studies not strongly associated with all main categories and individual 12-month mental disorders at baseline, after controlling for sociodemographics (De Graaf et al., 2000a, 2000b; 2013). Based on the pooled dataset, attrition was not significantly associated with all four types of CM (see hereunder) at baseline, except for sexual abuse which was associated with a lower chance of attrition at follow-up (unadjusted OR = 0.81; 95% CI = 0.69–0.94; p = .006).

Both studies were approved by a medical ethics committee. After having been informed about the study aims, NEMESIS-2 respondents provided written informed consent at each wave, and NEMESIS respondents verbal informed consent according to the prevailing Dutch law of 1996. See for a more comprehensive description of the study designs: Bijl et al. (1998) and De Graaf et al. (2010).

2.1. Independent variable: CM

CM was assessed at baseline using a questionnaire developed for NEMESIS (De Graaf et al., 2010). Whenever a subject reported having experienced one of four types of CM before the age of 16 (emotional abuse [ignored or unsupported], psychological abuse [yelled at, insulted or threatened], physical abuse [kicked, hit, bitten or hurt], and sexual abuse [any unwanted sexual experience]), they were asked to state how often it had occurred, on a scale of 1 (once) to 5 (very often). As was done in previous studies (Hovens et al., 2012, 2015), we did create the same CM severity scores. These frequencies were divided into three groups (0: absent, 1: once or sometimes, 2:regularly, often and very often). An overall CM score was created, indicating presence of any CM or not. An overall cumulative CM score was created, ranging from 0 to 8, with a higher score indicating more types and higher frequency of CM.

The NEMESIS CM questionnaire has been used in the Netherlands Study of Depression and Anxiety (NESDA) (e.g. Hovens et al., 2015). This questionnaire shows a high similarity with the Childhood Trauma Interview (Fink et al., 1995), which is a reliable and valid method for brief assessment of multiple dimensions of childhood interpersonal trauma (Hovens et al., 2012).

2.2. Dependent variable: incident mental disorders

In both studies diagnoses of common mental disorders were made using the Composite International Diagnostic Interview (CIDI). This instrument is a fully structured lay-administered diagnostic interview, developed by the World Health Organization (1990). In NEMESIS, version 1.1 (Smeets and Dingemans, 1993) was used to determine DSM-III-R diagnoses; in NEMESIS-2, version 3.0 (Kessler and Üstün, 2004) generated DSM-IV diagnoses.

The following CIDI-diagnoses were recorded at each wave: mood (i.e. major depression, dysthymia, and bipolar disorder), anxiety (i.e. panic disorder, agoraphobia without panic disorder, social phobia, and generalized anxiety disorder: post-traumatic stress disorder was not assessed) and substance use disorders (alcohol/drug abuse and dependence). At baseline, lifetime and 12-month disorders were assessed. For this paper, three-year incident (first-onset or recurrent) disorders were calculated among those without a 12-month disorder at baseline (i.e. the population at risk).

Previous studies found that the CIDI 1.1 (Wittchen, 1994) and 3.0 (Haro et al., 2006) assess these common mental disorders with generally good validity in comparison to blinded clinical reappraisal interviews.

2.3. Vulnerability characteristics

In both studies, all vulnerability characteristics were assessed at baseline, otherwise it is mentioned below.

Partners status refers to living with a partner or not.

Social support refers to emotional and instrumental support from people in the close network as well as the respondent's evaluation of these types of support, based on Doeglas et al. (1996). The scores were dichotomised into 0 (highest four quintiles, defined as 'high social support') and 1 (lowest quintile, defined as 'low social support'). In NEMESIS social support was assessed at the (1-year) follow-up wave; in NEMESIS-2 it was also assessed at first follow-up (3-year).

Any negative life event refers to presence of at least one of ten negative life events in the past 12 months, based on Brown et al. (1994) and Brugha et al. (1985). Examples of negative life events are a serious disease of a dear friend, death of a loved one, divorce and loss of employment. In NEMESIS these events were assessed at the second wave, i.e. 12 months after baseline; in NEMESIS-2 at baseline.

Parental psychopathology was defined as at least one biological parent ever having been treated by a psychiatrist, or hospitalized in a mental institution, or ever having exhibited one or more of the following problems: severe depression, delusions or hallucinations, severe anxiety or phobias, alcohol abuse, drug abuse (only in NEMESIS-2), regular problems with the police, and suicidal behaviour. In NEMESIS-2 this was assessed at follow-up; in NEMESIS at baseline.

Neuroticism. In NEMESIS, this was assessed with the short form of the Neuroticism Scale from the Amsterdam Biographical Questionnaire (Ormel and Wohlfarth, 1991), a 14-item, 3-point scale (Cronbach's alpha = 0.80). In NEMESIS-2, it was assessed with the Eysenck Personality Questionnaire Revised Short Scale (Eysenck et al., 1976, 1985), a 12-item, 2 point scale (Cronbach's alpha = 0.80). In both studies the scores were assessed at baseline and dichotomised into 0 (lowest three quartiles, defined as 'low neuroticism') and 1 (highest quartile, defined as 'high neuroticism').

Any chronic physical disorder was defined as presence of at least one of 16 chronic physical disorders treated or monitored by a medical doctor in the 12 months prior to baseline, assessed with a standard checklist. Comparisons between self-reports of chronic physical disorders and medical records show moderate to good concordance (National Centre for Health Statistics, 1994; Baker et al., 2001).

Prior mental disorder was defined as a lifetime but not 12-month disorder at baseline.

Any other mental disorder was defined as a 12-month disorder at baseline other than the index disorder.

2.4. Statistical analyses

Statistical analyses were performed with STATA version 12.1. As the research questions focus on association rather than prevalence or incidence, sampling weights were not applied, except when prevalence rates of CM were calculated (Table 1). In order to adjust for clustering of data within studies, all regression models included a dummy for the study (study-ID) (Snijders and Bosker, 2011).

First, prevalence rates of all types of CM by gender and age were calculated (Table 1). Second, logistic regression analyses were performed to study the associations between each type of CM and main categories of adult incident common mental disorders after adjustment for gender, age and study-ID (Table 2). Beside odds ratios (OR), population attributable fractions (PAF) were calculated. The PAF describes the percentage by which the incidence rate of a mental disorder in the general population can be reduced when the risk factor (CM) is completely eliminated, or when its adverse effect is completely contained. This attributable fraction is best interpreted as a statistic that puts an upper limit to the health gain that could be generated in a population. Third, logistic regression analyses were performed to study the mediating and moderating role of vulnerability characteristics in the longitudinal associations between any CM and each main category of adult incident common mental disorders after adjustment for gender, age and study-ID (Table 3 en 4).

In order to detect mediating effects, stepwise analyses were performed. First, we examined whether any CM was associated with incidence of adult mental disorders after adjustment for gender, age and study-ID. Second, we added a vulnerability characteristic in the analysis. The Sobel test was used to test for significance of mediation (Sobel, 1986) after correction for the dichotomous nature of the mediator and outcome variable (MacKinnon and Dwyer, 1993). Baron and Kenny's proportion of the effect mediated was calculated as well, using a practical tool available at http://www.nrhpsych.com/mediation/logmed.html.

In order to detect moderating or interaction effects, an additive model was used (see e.g.: Ten Have et al., 2002; Tuithof et al., 2012). Additive interaction exists if the combined effect of CM and a vulnerability characteristic on incident mental disorder is stronger than the sum of the separate effects. Additive interaction effects were estimated by comparing the OR of the CM and the vulnerability characteristic combined with the expected value in case of no interaction. If the expected OR, that is OR(AB) ≈ OR(A) + OR(B) – 1, lays below the lower limit of the confidence interval of the combined effect, additive interaction is assumed (Ahlbom and Alfredsson, 2005; Rothman, 2002).

3. Results

Of the respondents, 29.2% had experienced any CM. Emotional (19.0%) and psychological abuse (15.0%) were most often reported, physical and sexual abuse less often (< 10%). CM and a higher CM score were significantly related to gender and age (Table 1). Women and those aged 35–54 more often reported CM than men and younger and older respondents, respectively.

Table 1

Sociodemographic characteristics of childhood maltreatment in the general population (N = 13,582), in unweighted numbers and weighted row percentages.

	Emotional abuse	Psychological abuse	Physical abuse	Sexual abuse	Any childhood maltreatment	Childhood maltreatment score		
						0	1–3	4–8
n (%)	2,690 (19.0)	2,134 (15.0)	1,253 (9.1)	1,036 (7.2)	4,054 (29.2)	9,435 (70.8)	2,974 (21,8)	1,080 (7.4)
Gender								
Male	16.6	13.5	9.2	3.5	26.3	73.7	20.8	5.5
Female	21.5***	16.4***	9.0	11.1***	32.2***	67.8***	22.7***	9.5***
Age at interview								
18–34	16.9	13.1	8.2	6.6	26.8	73.2	20.7	6.0
35–44	21.1	15.8	9.5	8.1	31.3	68.7	23.4	8.0
45–54	20.9***	17.3***	10.1*	7.8	31.7***	68.3***	22.9***	8.8***
55–64	18.1	14.9	9.1	6.8	28.1	71.9	20.1	7.9

*: $P < .05$; **: $P < .01$; ***: $P < .001$.

Table 2

Associations between childhood maltreatment and incident common mental disorders in adulthood in the general population, in unweighted numbers and odds ratios (OR) with 95% confidence intervals and population attributable fractions (PAF) adjusted for gender, age and study-ID.

	Total (at risk)	Cases	Emotional abuse	Psychological abuse		Physical abuse		Sexual abuse		Any childhood maltreatment		Childhood maltreatment score	
												1–3	4–8
	N	n	OR	PAF	OR	PAF	OR	PAF	OR	PAF	OR	OR	OR
3-year first-onset or recurrence													
Mood disorder	9337	682	2.98 [2.52,3.53]***	23.4	2.42 [2.01,2.91]***	14.5	2.63 [2.12,3.27]***	9.8	2.29 [1.82,2.89]***	7.8	2.68 [2.29,3.15]***	2.32 [1.95,2.78]***	3.96 [3.13,5.03]***
Anxiety disorder	9304	396	2.72 [2.20,3.38]***	22.3	2.44 [1.94,3.06]***	16.0	2.29 [1.73,3.04]***	8.6	1.41 [1.02,1.96]*	3.1	2.21 [1.80,2.72]***	1.84 [1.46,2.32]***	3.45 [2.58,4.62]***
Substance use disorder	9474	432	2.07 [1.66,2.58]***	14.5	1.72 [1.34,2.21]***	8.0	1.71 [1.28,2.30]***	5.2	2.05 [1.47,2.87]***	5.0	1.79 [1.46,2.19]***	1.48 [1.17,1.87]***	2.94 [2.16,4.00]***
Any mental disorder	8495	994	2.46 [2.11,2.87]***	15.7	1.96 [1.66,2.33]***	9.0	2.11 [1.72,2.60]***	6.0	1.71 [1.36,2.15]***	3.7	2.08 [1.81,2.39]***	1.86 [1.59,2.17]***	2.96 [2.35,3.71]***

*: $P < .05$; **: $P < .01$; ***: $P < .001$.

All types of CM were associated with an increased likelihood of incident mental disorders in adulthood, after adjustment for gender, age and study-ID. Respondents who experienced any CM were significantly more likely to suffer from all main categories of common mental disorders. The ORs varied between 1.8 and 2.7 with associated PAFs varying between 16% and 30% (Table 2: last column). An increased score on the CM index was also associated with an increased likelihood of incident mental disorders. In general, CM was slightly stronger associated with mood and anxiety disorder than with substance use disorder. Among the various types of CM, emotional abuse was strongest associated with all main categories of common mental disorders and sexual abuse weakest; however, most confidence intervals overlapped. The associations between any CM and all main categories of incident mental disorders were significant at $p < .001$ in both studies, except the association between any CM and substance use disorder which was significant at $p < .003$ in NEMESIS-2 (not tabulated). The associations between any CM and all main categories of incident mental disorders did not significantly differ between both studies, indicating that these associations are robust.

CM almost tripled the risk of incident mood disorder at follow-up. Table 3 shows that this risk decreased from 2.68 (step 1) to 2.19 (step 2) when high neuroticism was added to the model (a significant reduction; Sobel test: $Z = 10.97$; $p < .0001$), indicating that this association was partially mediated by this vulnerability characteristic.

To investigate whether the association between CM and incident mood disorder operates via another vulnerability characteristic as mediating variable, we compared the ORs of CM before and after adjustment for other vulnerability characteristics. Based on the Sobel test, all reductions in ORs of CM were significant (Sobel test: $Z > 3.80$; $p < .001$), indicating partial mediation. Neuroticism and prior mood disorder accounted for the highest proportion of the effect mediated.

To investigate whether one of the vulnerability characteristics altered the effect of CM on incident mood disorder, we compared the combined effect of CM and a particular vulnerability characteristic on mood disorder with the expected OR in the case of no interaction (Table 4). Six out of eight interaction effects were significant, indicating that CM has a significantly greater effect on adult mood disorders among people with these vulnerability characteristics (i.e. not living with a partner, low social support, parental psychopathology, high neuroticism, prior mood disorder and another baseline mental disorder). To give an example, the combined effect of CM and not living with a partner on incident mood disorder (95% CI of OR = 3.12–4.88) is stronger than the sum of the separate effects (OR = 2.60).

CM doubled the risk of incident anxiety disorder. Analyses showed partial mediation by all vulnerability characteristics (Table 3: not living with a partner: Sobel test: $Z = 2.96$; $p < .01$; chronic physical disorder: Sobel test: $Z = 3.45$; $p < .001$; all other characteristics: Sobel test: $Z > 4.34$; $p < .0001$). Again, neuroticism and prior anxiety disorder accounted for the highest proportion of the effect mediated. There was a significant moderating role of five vulnerability characteristics in the association between CM and incident anxiety disorder (Table 4: i.e. low social support, negative life event, parental psychopathology, high neuroticism and prior anxiety disorder).

CM almost doubled the risk of incident substance use disorder. Analyses showed partial mediation by all vulnerability characteristics (Table 3: low social support: Sobel test: $Z = 2.09$; $p < .05$; negative life event: Sobel test: $Z = 2.94$; $p < .01$; other characteristics: Sobel test: $Z > 4.65$; $p < .001$), except for chronic physical disorder which did not mediate the association. Again, neuroticism and prior substance use disorder accounted for the highest proportion of the effect mediated. There was a significant moderating role of three vulnerability characteristics in the association between CM and incident substance use disorder (Table 4: i.e. low social support, parental psychopathology and prior substance use disorder).

CM doubled the risk of any incident common mental disorder at follow-up. Analyses showed partial mediation by all vulnerability

Table 3

Mediating role of vulnerability characteristics in the associations between childhood maltreatment and incident common mental disorders in adulthood in the general population, in odds ratios (OR) with 95% confidence intervals adjusted for gender, age and study-ID.

	Any mood disorder			Any anxiety disorder			Any substance use disorder			Any mental disorder		
	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated
Any childhood maltreatment (CM)	2.68 [2.29,3.15]***			2.21 [1.80,2.72]***			1.79 [1.46,2.19]***			2.08 [1.81,2.39]***		
Any CM	2.62 [2.23,3.07]***	3.80	3.8%	2.16 [1.75,2.65]***	2.96	4.5%	1.71 [1.39,2.10]***	5.49	13.0%	2.04 [1.77,2.35]***	4.76	5.9%
No partner	1.44 [1.21,1.70]***			1.41 [1.14,1.75]**			2.09 [1.71,2.57]***			1.52 [1.32,1.76]***		
Any CM	2.58 [2.20,3.04]***	5.28	7.3%	2.06 [1.67,2.53]***	5.38	11.4%	1.77 [1.44,2.17]***	2.09	5.7%	2.05 [1.78,2.36]***	3.70	5.8%
Low social support	1.74 [1.45,2.09]***			2.02 [1.61,2.53]***			1.29 [1.02,1.63]*			1.39 [1.18,1.64]***		
Any CM	2.59 [2.20,3.04]***	5.51	6.4%	2.12 [1.72,2.60]***	4.34	7.3%	1.74 [1.42,2.14]***	2.94	5.9%	2.03 [1.77,2.34]***	5.38	6.9%
Any negative life event	1.81 [1.54,2.14]***			1.72 [1.39,2.13]***			1.38 [1.13,1.68]**			1.61 [1.40,1.85]***		
Any CM	2.43 [2.07,2.86]***	6.13	11.7%	1.95 [1.59,2.41]***	5.80	17.4%	1.63 [1.33,2.01]***	4.65	18.5%	1.93 [1.68,2.22]***	6.11	13.6%
Parental psychopathology	1.72 [1.46,2.03]***			1.92 [1.56,2.36]***			1.65 [1.35,2.03]***			1.59 [1.38,1.84]***		
Any CM	2.19 [1.85,2.58]***	10.97	26.6%	1.70 [1.37,2.10]***	10.43	38.8%	1.49 [1.20,1.84]***	7.07	35.2%	1.78 [1.54,2.06]***	10.83	31.8%
High neuroticism	2.93 [2.47,3.46]***			3.58 [2.89,4.42]***			2.28 [1.84,2.83]***			2.58 [2.22,3.00]***		
Any CM	2.63 [2.24,3.09]***	3.95	3.5%	2.16 [1.76,2.65]***	3.45	4.5%	1.77 [1.44,2.17]***	1.23	2.0%	2.05 [1.78,2.36]***	3.60	3.6%
Any chronic physical disorder	1.51 [1.28,1.79]***			1.54 [1.25,1.91]***			1.15 [0.92,1.43]			1.37 [1.19,1.59]***		
	Any mood disorder			Any anxiety disorder			Any substance use disorder			Any mental disorder		
	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated	OR	Z (Sobel test)	% of effect mediated
Any CM	2.18 [1.84,2.57]***	11.61	30.2%	1.96 [1.59,2.42]***	7.75	27.7%	1.54 [1.25,1.89]***	9.13	36.7%	1.73 [1.50,2.00]***	11.59	35.9%
Prior disorder	3.35 [2.81,4.00]***			3.02 [2.34,3.89]***			4.06 [3.26,5.05]***			2.59 [2.24,2.98]***		
Any CM	2.50 [2.13,2.94]***	6.85	13.7%	1.95 [1.58,2.40]***	8.19	26.3%	1.57 [1.27,1.94]***	6.27	30.3%	Not applicable		
Any other baseline mental disorder	2.33 [1.88,2.89]***			3.51 [2.72,4.53]***			2.46 [1.89,3.21]***					

*: $P < .05$; **: $P < .01$; ***: $P < .001$.

% of effect mediated is based on Baron and Kenny's calculation of the percentage of effect mediated.

Table 4
Moderating role of vulnerability characteristics in the associations between childhood maltreatment and incident common mental disorders in adulthood in the general population, in odds ratios (OR) with 95% confidence intervals adjusted for gender, age and study-ID.

	Any mood disorder		Any anxiety disorder		Any substance use disorder		Any mental disorder	
	OR	exp. OR	OR	exp. OR	OR	exp. OR	OR	exp. OR
No CM, partner	1.00		1.00		1.00		1.00	
No CM, no partner	1.24 [0.98,1.58]		1.51 [1.13,2.02]**		2.27 [1.75,2.94]***		1.60 [1.33,1.92]***	
Any CM, partner	2.36 [1.93,2.88]***		2.27 [1.75,2.95]***		1.87 [1.42,2.47]***		2.13 [1.79,2.53]***	
Any CM, no partner	**3.91 [3.12,4.88]***	2.60	2.98 [2.22,4.00]***	2.78	3.48 [2.59,4.67]***	3.14	3.00 [2.43,3.71]***	2.73
No CM, high social support	1.00		1.00		1.00		1.00	
No CM, low social support	1.77 [1.36,2.30]***		1.72 [1.23,2.40]**		1.07 [0.77,1.50]		1.23 [0.98,1.54]	
Any CM, high social support	2.61 [2.16,3.15]***		1.87 [1.45,2.40]***		1.60 [1.25,2.03]***		1.92 [1.63,2.26]***	
Any CM, low social support	**4.47 [3.50,5.71]***	3.38	**4.39 [3.28,5.87]***	2.59	**2.54 [1.86,3.47]***	1.67	**3.10 [2.46,3.89]***	2.15
No CM, no negative life event	1.00		1.00		1.00		1.00	
No CM, negative life event	2.16 [1.71,2.72]***		1.60 [1.21,2.12]**		1.29 [1.00,1.66]		1.63 [1.37,1.94]***	
Any CM, no negative life event	3.27 [2.51,4.27]***		1.90 [1.33,2.70]***		1.57 [1.13,2.16]**		2.08 [1.67,2.59]***	
Any CM, negative life event	4.88 [3.85,6.19]***	4.43	**3.59 [2.71,4.77]***	2.50	2.42 [1.84,3.18]***	1.86	3.27 [2.69,3.96]***	2.71
No CM, no parental psychopathology	1.00		1.00		1.00		1.00	
No CM, parental psychopathology	1.59 [1.26,2.00]***		1.74 [1.30,2.32]***		1.56 [1.19,2.04]**		1.46 [1.22,1.76]***	
Any CM, no parental psychopathology	2.26 [1.82,2.82]***		1.76 [1.31,2.37]***		1.53 [1.16,2.03]**		1.77 [1.47,2.14]***	
Any CM, parental psychopathology	**4.23 [3.43,5.20]***	2.85	**3.79 [2.91,4.92]***	2.50	**2.75 [2.11,3.59]***	2.09	**3.19 [2.64,3.85]***	2.23
No CM, low neuroticism	1.00		1.00		1.00		1.00	
No CM, high neuroticism	3.13 [2.48,3.96]***		3.48 [2.62,4.64]***		2.23 [1.67,2.98]***		2.67 [2.18,3.26]***	
Any CM, low neuroticism	2.32 [1.86,2.88]***		1.65 [1.21,2.24]**		1.46 [1.11,1.92]**		1.83 [1.53,2.18]***	
Any CM, high neuroticism	**6.34 [5.12,7.85]***	4.45	**6.08 [4.66,7.91]***	4.13	3.41 [2.61,4.47]***	2.69	**4.53 [3.71,5.53]***	3.50
No CM, no chronic physical disorder	1.00		1.00		1.00		1.00	
No CM, chronic physical disorder	1.70 [1.36,2.14]***		1.68 [1.27,2.24]***		1.14 [0.85,1.51]		1.45 [1.20,1.74]***	
Any CM, no chronic physical disorder	2.91 [2.36,3.59]***		2.34 [1.78,3.07]***		1.75 [1.37,2.25]***		2.16 [1.81,2.58]***	
Any CM, chronic physical disorder	3.89 [3.08,4.92]***	3.61	3.27 [2.44,4.39]***	3.02	2.05 [1.51,2.79]***	1.89	2.73 [2.21,3.37]***	2.61
No CM, no prior disorder	1.00		1.00		1.00		1.00	
No CM, prior disorder	3.64 [2.82,4.70]***		2.82 [1.90,4.18]***		3.93 [2.96,5.21]***		2.59 [2.16,3.11]***	
Any CM, no prior disorder	2.29 [1.87,2.81]***		1.91 [1.51,2.42]***		1.49 [1.15,1.94]**		1.74 [1.43,2.11]***	
Any CM, prior disorder	**7.16 [5.73,8.94]***	4.93	**6.08 [4.42,8.35]***	3.73	**6.35 [4.72,8.54]***	4.42	**4.47 [3.71,5.39]***	3.33

	Any mood disorder		Any anxiety disorder		Any substance use disorder		Any mental disorder	
	OR	exp. OR	OR	exp. OR	OR	exp. OR	OR	exp. OR
No CM, no other baseline mental disorder	1.00		1.00		1.00		Not applicable	
No CM, any other baseline mental disorder	2.48 [1.80,3.40]***		3.91 [2.71,5.63]***		2.54 [1.71,3.77]***		Not applicable	
Any CM, no other baseline mental disorder	2.55 [2.13,3.04]***		2.03 [1.61,2.57]***		1.59 [1.26,2.00]***		Not applicable	
Any CM, any other baseline mental disorder	**5.67 [4.29,7.48]***	4.03	6.53 [4.69,9.08]***	4.94	3.81 [2.75,5.29]***	3.13	Not applicable	

*: $P < .05$; **: $P < .01$; ***: $P < .001$.
Expected OR in the case of no interaction is the sum of the separate effects of childhood maltreatment and a vulnerability characteristic.
Bold ORs indicate additive interaction. This is assumed if the expected OR lays below the lower limit of the confidence interval of the combined effect of childhood maltreatment and a vulnerability characteristic.

characteristics (Table 3: all characteristics: Sobel test: Z > 3.60; p < .001) and a moderating role of four vulnerability characteristics in the association between CM and any incident common mental disorder (Table 4: i.e. low social support, parental psychopathology, high neuroticism and prior mental disorder). Additional analyses using the CM index resulted in similar findings (Sobel test varied between 3.53 and 11.47), which supports the robustness of our findings.

4. Discussion

4.1. Key findings

CM is highly prevalent, with 29.2% of respondents reporting any emotional, psychological, physical or sexual abuse before the age of 16, and it doubled the risk of developing an incident (first-onset or

recurrent) common mental disorder at follow-up (OR = 2.08). As CM accounted for 18.8% of these disorders, this implies that the risk of any incident mental disorder can be reduced to 1.69 (=2.08*(1–0.188)) when the adverse effects of CM are completely eliminated.

CM had a direct and an indirect effect via vulnerability characteristics on incident mental disorders in adulthood. Several vulnerabilities also moderated the relationship, indicating that these vulnerability factors had a greater effect on incident mental disorders among people with CM. As not all adults with such history develop mental disorders, these mediating and moderating risk factors might help identify adults exposed to childhood abuse who could benefit from preventive interventions.

4.2. Strengths and limitations

This study had the advantage of a longitudinal design and the use of a standardized diagnostic instrument to assess the association between CM and adult incident mental disorders in the general population, and to investigate to what extent a variety of vulnerability characteristics contribute to the impact of CM on adult psychopathology. However, some limitations have to be mentioned.

Although the NEMESIS samples were representative of the Dutch population on most parameters, people with an insufficient mastery of Dutch, those with no fixed address and institutionalised people were underrepresented. Hence, our findings are not generalizable to these groups.

Recall bias of CM primarily involves underreporting of childhood abuse (Hardt and Rutter, 2004). It is difficult to gauge how this might have influenced the results of our study, but it would probably have weakened the effect of CM on adult mental disorders. The prevalence of CM was not likely affected by a more negative state of mind during the interview, a phenomenon re-appraised by Brewin et al. (1993), as those with a 12-month disorder at baseline were excluded from analyses on incident mental disorders at follow-up.

In the NEMESIS CM questionnaire, previously used in the NESDA study (see e.g. Hovens et al., 2015), no specific information was available about the age of onset and duration of the abuse. This means that we cannot assess whether findings would be different if we confined the analyses to those with an earlier age of onset and/or longer duration of abuse and a comparison group.

In both NEMESIS-studies not all possible vulnerability characteristics for developing mental disorders were assessed, such as insecure attachment styles (Bifulco et al., 2006), lower resilience and disruptions in emotional processing (McLaughlin, 2016). Therefore, their potential as mediator and moderator of the relationship between CM and adult incident mental disorders could not be studied.

The dependent variable consisted of first-onset and recurrent cases. It would have been interesting to investigate whether the mediating and moderating effects found also hold for the prediction of first-onset and recurrent mental disorders separately. However, despite our large sample size, the power to detect such three-way interactions was too low.

4.3. Discussion of the research findings

All types of CM were associated with incident mood, anxiety and substance use disorders in adulthood, also with little meaningful variation in these associations across types of maltreatment. These non-specific patterns of risk may mean that CM engenders a generalized liability to both internalising and externalising dimensions of psychopathology (Keyes et al., 2012). It is not likely the result of the fact that mental disorders overlap to a great extent. Compared to a clinical study comorbidity between disorders is less common in a population study such as NEMESIS. In the present aggregated dataset, 36.8% of those with a 12-month mood disorder at baseline had a comorbid 12-month anxiety disorder and 36.9% of those with a 12-month anxiety disorder at baseline had a comorbid 12-month mood disorder.

Any CM was associated with 16–29% of all incident mental disorders in adulthood. This is somewhat lower than in previous studies, probably because previous studies retrospectively assessed first-onset disorders from 18 years onward and assessed a wider variety of disorders (Green et al., 2010; Kessler et al., 2010). Despite some dissimilarity in findings, these population attributable fractions stress the pervasive impact that CM has on adult mental health and the need to better understand the underlying mechanisms and moderators of the relationship between CM and adult mental disorders.

CM was not only directly connected to adult incident mental disorders, but also indirectly through vulnerability characteristics. Similar to previous studies (Hovens et al., 2012, 2016; Lee and Song, 2017;

Salazar et al., 2011; Sheikh, 2018), we found consistent evidence for partial mediation via social support, neuroticism and prior mental health. We also found indirect effects of childhood abuse via life events on adult incident mental disorders, whereas previous studies did not always find such an effect (mediation of life events found by Korkeila et al., 2005; LaNoue et al., 2012; not found by Kok et al., 2014; Sousa et al., 2017). The present study extends previous findings by showing that neuroticism and a prior mental disorder accounted for the highest proportion of the total effect mediated, implying that these risk factors are strong mediating variables in the association between CM and adult psychopathology.

There are many different types of social support conceivable. This study distinguished two types: partner status to signify the structural dimension of social relationships, and perceived social support to express the functionally supportive content of social relationships. Overall, it turned out that social support had a stronger mediating and moderating role in the association between CM and incident mental disorders than someone's partner status. This is in line with a previous study that found support for a mediating role of loneliness, but not partner status, for early-onset depression among older adults (Wielaard et al., 2017).

While previous studies did not find consistent evidence for a moderating role of social support in the relationship between childhood adversity and mental health (moderation found by: Hill et al., 2001; Salazar et al., 2011; Sperry and Spatz Widom, 2013; not found by: Herrenkohl et al., 2016; Oshio et al., 2013; Von Cheong et al., 2017), we did. Most previous studies assessed general distress or depressive symptoms, or used a rather selective sample of the general population, which could have led to different findings.

This study found some support for a moderating effect of negative life events, i.e. only in the association between CM and incident anxiety disorders. It is conceivable that if the assessment of life events had included an evaluation of the stress induced by these events, there would have been a more consistent and stronger moderating role of these events. This is in line with a previous study that found a moderating effect of life events only at high levels of stress (Bandoli et al., 2017).

Consistent with the few studies that focused on other vulnerability factors (Brensilver et al., 2011; Fenton et al., 2013), this study found a moderating role of prior mental health and parental psychopathology. It extends previous findings by showing that this role also holds true for neuroticism.

The role of vulnerability characteristics in the associations between CM and adult incident mental disorders varied little across main categories of disorders. This suggests the existence of general mechanisms underlying these associations. McLaughlin and Lambert (2017) have recently formulated a biopsychosocial model outlining these possible mechanisms and protective factors that can mitigate the risk pathways between childhood trauma and psychopathology. This model describes four mechanisms of enhanced threat processing (i.e. information processing biases, altered emotional learning, heightened emotional reactivity and emotion regulation difficulties) that mediate the link between childhood trauma and both internalising and externalising psychopathology. Caregiver support is viewed as a protective factor that buffers people from enhanced threat processing or from experiencing psychopathology after a traumatic event. Future studies should include such neurodevelopmental variables and potential buffers or moderating factors (such as personality characteristics in Hovens et al., 2016) to better understand the underlying associations between CM and onset of psychopathology.

To conclude, the vulnerability characteristics found in this study may help to identify persons with a history of maltreatment who could benefit from preventive interventions. Interventions – reducing neuroticism, enhancing social support, learning to better cope with negative life events – might contribute to the prevention of first-onset and recurrence of psychopathology in adults with a history of CM.

Conflicts of interest

All authors have contributed to and have approved the manuscript entitled *Childhood maltreatment, vulnerability characteristics and adult incident common mental disorders: 3-year longitudinal data among > 10,000 adults in the general population.*

All authors do not have any potential competing interests.

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