General risk or individual vulnerability? Individual differences in young adults' health risk behaviour after childhood trauma

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ABSTRACT

The present study aims at replicating earlier findings regarding the link between childhood trauma and young adults' health risk behaviours and extends previous work by examining potential moderating effects of demographic and trait characteristics. Specifically, the current study enables to disentangle individual differences in response to trauma and separate the effect of trauma on health risk behaviours from possible confounders known to be associated with health risk behaviours. Data were used from a large British sample of young adults (N = 236,755, age 18–35) who participated in an online survey. Young adults who had experienced the sudden death of a loved one, violence, or non-sexual abuse in childhood, scored higher on a range of health risk behaviours. There was a cumulative effect; the more traumatic events an individual experienced, the more health risk behaviours they reported. Some support was found for individual differences in health risk behaviour after trauma. All moderating effects were, however, very small. The findings confirm and extend prior work on childhood trauma and young adult outcomes by providing evidence for long-term correlates, and highlight the value of big data studies to increase our understanding of the subtle individual differences in adverse outcomes after trauma.

1. Introduction

Psychological trauma is defined by exposure to an event in which someone experienced, witnessed or was confronted by an event that involved actual threatened death, serious injury, or a threat to the physical integrity of the self or others (American Psychiatric Association, 2013). Whereas there is a great deal of uncertainty with regard to the frequency with which traumatic events occur during childhood (e.g., prevalence rates of childhood sexual abuse range from 2% to 62%; Andrews, Corry, Slade, Issakidis, & Swanston, 2004), the impact of childhood trauma has been increasingly investigated and acknowledged (Norman et al., 2012). Studies on childhood trauma have traditionally focused on, and found substantial support for, effects of trauma on post-traumatic stress symptoms (PTSS), problems in the internalizing domain and life satisfaction (Alisic et al., 2014; Ozer, Best, Lipsey, & Weiss, 2008; Whitelock, Lamb, & Rentfrow, 2013). Additionally, there is increasing support that childhood trauma may also place individuals at risk for problems in the externalizing domain (Fergusson, McLeod, & Horwood, 2013; Gabert-Quillen, Selya, & Delahanty, 2015). This seems particularly true with regard to risk

behaviours during young adulthood. Whereas mild risky behaviours are quite common during adolescence but are often limited to the adolescent and young adult years (Bradley & Wildman, 2002), risk behaviour that develop in the context of trauma might be more persistent and set the stage for further adult functioning. So far, child and adolescent trauma appear to be related to a range of young adult risk behaviours (for a review see: Ben-Zur & Zeidner, 2009; for a meta-analysis see: Norman et al., 2012). For example, individuals exposed to childhood trauma reported more smoking (Gabert-Quillen et al., 2015; Roberts, Fuemmeler, McClernon, & Beckham, 2008), sexual risk, alcohol-dependence and illicit drug use (Fergusson et al., 2013).

Combining the findings from studies, links between childhood trauma and young adult health-risk behaviours seem highly consistent, regardless of the nature of childhood trauma or type of health risk behaviour under study. However, these studies have generally examined only one type of trauma and a limited range of risk behaviours (mostly smoking). Nonetheless, there is increasing evidence for the relative impact of multiple traumatic experiences and on the potentially domain specific effects of trauma on specific risk behaviours. Specifically, childhood traumatic experiences showed stronger linked to

first-onset mental disorders (including substance abuse disorders) than non-family-related events (Kessler et al., 2010). So far, it is unknown whether these findings generalize to other health risk behaviours.

Additionally, whereas research has generally focused on the unique effects of specific types of trauma, there is some evidence for cumulative effects. Although some studies have found relatively strong effects (e.g., Kessler et al., 2010), small effects of individual stressful or traumatic events are quite common (e.g., Laceulle et al., 2014; Suldo & Huebner, 2004). However, these may accumulate if individuals are exposed to multiple events (Forehand, Biggar, & Kotchick, 1998). Indeed, in a nationally representative sample of children aged 2–17 it was found that cumulative exposure to multiple forms of victimization over a child's life-course represents a substantial source of mental health risk (Turner, Finkelhor, & Ormrod, 2006). Findings like these underscore the importance of taking into account potential cumulative effects.

1.1. Individual differences in young adult risk behaviours after trauma

Importantly, not everyone exposed to traumatic experiences during childhood may be at risk for adverse outcomes. However, because most studies on trauma and specific risk behaviours have involved small samples, statistical power has often been insufficient to detect subtle individual differences. Nevertheless, studies of risk factors associated with PTSS, distress, and depression after trauma suggested a range of factors which may explain individual differences in sensitivity to trauma (Alisic et al., 2014; Tolin & Foa, 2006). For example, women may be more sensitive than men may to trauma (Breslau, 2009; Tolin & Foa, 2006) although men engage in more risky behaviours than women (Bradley & Wildman, 2002). Also, *SES* (low) and *current age* (younger) may enhance the adverse effects of trauma exposure (Cohen, Doyle, & Baum, 2006). In addition to these demographic characteristics, individual trait characteristics may also play a role. High *neuroticism* was found to place individuals at risk for PTSS and internalizing problems after trauma (Deković, Koning, Stams, & Buist, 2008; Ickovics et al., 2006). Additionally, *extraversion* and lack of *conscientiousness* may account for individual differences because these traits have repeatedly been linked health risk behaviours (Atherton, Robins, Rentfrow, & Lamb, 2014). Moreover, individuals high on extraversion engaged more in frequent substance use and those high on neuroticism reported poorer health than individuals who were low on extraversion and neuroticism (Atherton et al., 2014). Despite these associations with health outcomes, however, the role of personality and individual differences in the link between childhood trauma (both individual traumatic events and cumulative trauma) and young adult health risk outcomes has not been empirically tested.

1.2. Current study

In this study we aimed to replicate earlier findings on the link between childhood trauma and young adults' health risk behaviours by studying childhood trauma (i.e., death of a loved one, violence and sexual abuse) and a range of health-related risk behaviours (i.e., smoking, drinking, illicit drug use, risky sexual behaviour, severe accident/injury). The inclusion of both multiple traumatic experiences and a range of health-risk behaviours within the context of a single study is new to the literature. Strongest effects were expected for sexual abuse and violence. Cumulative effects were hypothesized, with exposure to multiple events being related to more health-risk behaviours. Differential effects in the five risk domains were explored. Subsequently, individual differences were hypothesized both with regard to demographic (gender, age, SES) and individual trait (neuroticism, extraversion and conscientiousness) characteristics. Strongest links between childhood trauma and risk behaviours were expected in women and young adults high on neuroticism. By examining the moderating effects of demographic and trait characteristics the current study enables to disentangle individual differences in response to

trauma and separate the effect of trauma on health risk behaviours from possible confounders known to be associated with health risk behaviours.

2. Methods

2.1. Design

A subsample of cases was drawn from a dataset collected as part of an online survey advertised and hosted by the British Broadcasting Corporation (BBC) on its "Lab UK" Web site (https://ssl.bbc.co.uk/labuk/experiments/personality/). The survey, called "The Big Personality Test," contained items pertaining to demographic and life histories, personality and well-being, among other topics (Atherton et al., 2014; Jokela, Bleidorn, Lamb, Gosling, & Rentfrow, 2015; Whitelock et al., 2013).

2.2. Participants and sampling

A total of 588,014 participants responded by April 14, 2011. Given the focus on young adult risk behaviours, this sample was reduced for the present study to include only those who 1) were between 18 and 35 years of age, 2) reported whether or not they were exposed to childhood trauma, and 3) had data on the health risk variables, demographic variables and personality traits. This resulted in a sample of 236,775 individuals. For more information on the procedure and (representativeness of) the sample, see Rentfrow, Jokela, & Lamb, (2015).

2.3. Measures

2.3.1. Risk behaviour

Risk behaviours were assessed using the Youth Risk Behavior Survey (Brener et al., 2002). Reliability of the Youth Risk Behavior Survey has been assessed extensively. Overall, students appeared to report health risk behaviours reliably over time (i.e., Kappas ranged from 23.6% to 90.5% and did not differ by gender, grade, or race/ethnicity of the respondent). The questionnaire has been used before both in studies using the current data (Atherton et al., 2014) and in other samples (Koesten & Anderson, 2004). For the current study, we included items that addressed the following behaviours: Smoking (average per day during the past 30 days ranging); Alcohol (number of days during the past 30 days); 'Recreational' drugs (lifetime number of times); Sexual risk (lifetime number of sexual partners); and Hospitalization through accident or injury (lifetime number of times).

2.3.2. Childhood Traumatic Events Scale

The Childhood Traumatic Events Scale (Pennebaker & Susman, 1988) contains items asking whether respondents had experienced any of six potentially traumatic events before age 17 years (yes, no, rather not say). The instrument has been shown to be reliable and valid (Pennebaker, 1993; Pennebaker & Susman, 1988), and has repeatedly been used before (Goldberg & Goldstein, 2000; Whitelock et al., 2013). Only events were included fitting the DSM-IV guidelines for traumatic experiences: (a) death of a loved one (b) sexual abuse (e.g., raped, molested) and (c) violence (e.g., child abuse, mugged or assaulted -other than sexual). To answer our research question with regard to cumulative effects, a sum score was calculated indicating the number of *yes* responses to these three items.

2.3.3. Big Five Inventory

The Big Five Inventory (John, Donahue, & Kentle, 1991) is a well-validated measure of the five basic domains of personality and was used to measure the personality dimensions extraversion, neuroticism and conscientiousness. Respondents were asked to specify the extent to which each statement applied to them on 5-point Likert scales. The internal consistency was high, with Cronbach's alphas of 0.85 for

Table 1
Frequencies of trauma exposure.

	Total		Male		Female	
	n	%	n	n	%	n
Death of a loved one (yes)	67,967	28.7	23,507	27.68	44,460	29.28
Sexual abuse (yes)	22,232	9.40	3312	3.90	18,920	12.46
Violence (yes)	29,815	12.6	13,253	15.60	16,562	10.92

extraversion, 0.83 for conscientiousness, and 0.83 for neuroticism. These reliabilities are comparable to those obtained when the questionnaire is administered in person.

2.3.4. Demographic characteristics

Socioeconomic class (SES), gender and age were taken into account. For SES, information on parent's social class and levels of education were aggregated and standardized (ranging from −3 to +3).

3. Results

3.1. Descriptive statistics

Frequencies of the traumatic experiences are reported in Table 1. Descriptive statistics are reported in Table 2. Correlation coefficients between all study variables are provided in Table 3a. Partial correlations between the trauma and health risk variables, after correcting for all demographic and trait characteristics are provided in Table 3b. Findings indicate that the associations between trauma and health risk are only slightly affected by the possible confounders. This suggests 1) that there are direct relations between trauma and health risk if all confounders are held constant and 2) that only a modest amount of variance is contributed by the moderating effects of demographic and trait characteristics.

3.2. Traumatic experiences and young adult health risk behaviour

To examine the domain-specific links between childhood traumatic experiences and health risk behaviours we used multiple regression analysis in which all three traumatic experiences were included as independent variables and all health risk behaviours were included as dependent variables. Results showed that all three traumatic experiences were significantly related to more health risk behaviours (respectively, death of a loved one: $F_{(5, 122,468)} = 165.58$, $p < .001$, partial $\eta^2 = 0.007$; sexual abuse: $F_{(5, 122,468)} = 165.58$, $p < .001$, partial $\eta^2 = 0.025$; violence: $F_{(5, 122,468)} = 639.89$, $p < .001$, partial $\eta^2 = 0.030$). Path estimates are reported in Table 4. Individuals exposed to violence during childhood reported higher scores on all five health risk behaviours. For sexual abuse, a similar pattern was found, except that individuals who experienced sexual abuse reported slightly

Table 2
Descriptive statistics.

	Min	Max	Mean	SD
Trauma total number of events	0	3	0.67	0.97
Smoking (average per day)	0	6	0.77	1.58
Alcohol (number of days in past 30 days)	0	6	1.35	1.55
Drugs (lifetime)	0	6	1.63	2.12
Sexual risk (number of sexual partners)	0	6	1.61	1.41
Severe accident/injury (life time)	0	6	1.17	1.59
Average health risk behaviour	0	6	1.35	1.05
Extraversion	1	5	3.24	0.82
Conscientiousness	1	5	3.49	0.70
Neuroticism	1	5	3.03	0.81
Age	18	35	25.19	5.23
SES	−3	3	0.08	2.01

less daily alcohol use. For the death of a loved one a slightly different pattern was found. Individuals exposed to death reported more smoking and more accident/injury, but less daily alcohol use, life time drug use, and sexual risk. Effects sizes for the latter three contrasting effects were, however, negligible (partial η^2 ranging from 0.000 to 0.001).

Multiple regression analysis was used to examine cumulative effects. A sum score indicating the number of events an individual was exposed to was included as the independent variable and all health risk behaviours were included as dependent variables. Overall, there was a positive association between the number of traumatic experiences and the number of health risk behaviours ($F_{(15, 367,410)} = 356.64$, $p < .001$, partial $\eta^2 = 0.014$), as well as for all but one of the individual health risk behaviours: Smoking: $F_{(122,472, 3)} = 634.95$, $p < .001$, partial $\eta^2 = 0.015$. Drug use: $F_{(122,472, 3)} = 464.36$, $p < .001$, partial $\eta^2 = 0.011$. Sexual risk taking: $F_{(122,472, 3)} = 828.74$, $p < .001$, partial $\eta^2 = 0.020$. Injury/accident: $F_{(122,472, 3)} = 378.39$, $p < .001$, partial $\eta^2 = 0.009$. There was a weak negative association between alcohol use and traumatic experiences: $F_{(122,472, 3)} = 21.33$, $p < .001$, partial $\eta^2 = 0.001$.

3.3. Individual differences in young adult health risk behaviours after trauma

Individual differences were tested by means of regression analyses. Because there were similar patterns for all health risk behaviours, we limited the number of analyses by focusing on the aggregated measure of (average) health risk. First, we considered the individual trauma scores, in a second analysis also the trauma sum score to examine potential interaction effects between cumulative trauma and individual characteristics.

3.3.1. Individual differences in health risk behaviour following the three traumata

The three traumatic experiences were entered in step 1, all individual difference measures were included in step 2 and the interaction terms were added in step 3. Variables were centred prior to calculating interaction terms. To limit the potential effects of multicollinearity in the moderation analyses, the model was run three times: First with the death × individual difference interaction terms; second with only sexual-abuse × individual differences; and finally with only violence × individual differences.

The three traumatic experiences during childhood explained 2.6% of inter-individual differences in overall health risk behaviours ($F_{(3, 236,751)} = 2106.95$, $p < .001$). Adding the individual differences variables to the model explained an additional 13.2% ($F_{(9, 236,745)} = 4938.68$, $p < .001$). Finally, adding the interaction terms hardly explained any additional variance: death-individual differences < 0.1% ($F_{(15, 236,739)} = 2966.92$, $p < .001$), sexual abuse-individual differences < 0.1% ($F_{(15, 236,739)} = 2979,27$, $p < .001$), violence-individual differences < 0.1% ($F_{(15,236,739)} = 2969.29$, $p < .001$). Parameter estimates (Table 5) showed that male, and individuals who were older, with lower SES, high on extraversion, high on neuroticism and low on conscientiousness reported more overall health risk behaviours. Associations between the individual differences variables and health risk behaviour were stronger in magnitude than those between the three traumatic experiences and health risk behaviour. With regard to individual differences in the link between trauma and overall health risk behaviours several significant interactions were found. For example, scoring higher on neuroticism had a small amplifying effect on the association between any of the traumatic experiences and health risk behaviours, and women reported more risk behaviours after sexual abuse, while men reported more after death of a loved one and violence. However, all effects sizes were negligible.

Table 3a

Correlations between main variables.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Death (experienced)														
2. Sexual abuse (experienced)	0.06*													
3. Violence (experienced)	0.08*	0.19*												
4. Trauma total	0.95*	0.36*	0.13*											
5. Smoking	0.05*	0.12*	0.14*	0.08*										
6. Alcohol	−0.01*	−0.03*	0.02*	−0.02*	0.25*									
7. Drugs	0.00	0.11*	0.14*	0.03*	0.45*	0.35*								
8. Sexual risk	0.01	0.13*	0.09*	0.03*	0.30*	0.26*	0.44*							
9. Serious accident	0.07*	0.06*	0.13*	0.09*	0.13*	0.11*	0.15*	0.12*						
10. Average health risk	0.03*	0.10*	0.14*	0.06*	0.67*	0.65*	0.80*	0.65*	0.54*					
11. Extraversion	0.02*	0.01*	0.01*	0.02*	0.06*	0.15*	0.09*	0.21*	0.09*	0.20*				
12. Conscientiousness	−0.02*	−0.03*	−0.07*	−0.03*	−0.15*	−0.14*	−0.17*	0.01*	−0.07*	−0.15*	0.12*			
13. Neuroticism	0.04*	0.10*	0.07*	0.07*	0.05*	−0.05*	−0.01*	−0.03*	0.001	−0.02*	−0.33*	−0.19*		
14. Age	−0.08*	0.05*	0.00	−0.06*	0.07*	−0.05*	0.18*	0.37*	−0.05*	0.14*	−0.00	0.19*	−0.04*	
15. SES	−0.06*	−0.03*	−0.05*	−0.06*	−0.07*	−0.001	−0.03*	−0.10*	−0.03*	−0.06*	0.02*	−0.03*	−0.04*	−0.12*
16. Gender (male = 1)	−0.02*	−0.14*	0.07*	−0.06*	0.16*	0.15*	0.03*	0.18*	0.19*	−0.06*	−0.13*	−0.22*	0.01*	−0.02*

* *p*-Values < .001.

3.3.2. Individual differences in health risk behaviour following cumulative trauma

The total trauma score was entered in step 1, all individual difference measures were included in step 2 and the interaction terms were added in step 3. Variables were centred prior to calculating interaction terms.

The total trauma score explained 0.3% of inter-individual differences in overall health risk behaviours (F (1, 236,753) = 784.54, $p < .001$). Adding the individual differences variables to the model explained an additional 13.9% (F (7, 236,747) = 5616.43, $p < .001$). Finally, adding the interaction terms hardly explained any additional variance: 0.01% (F (13, 236,741) = 3037.20, $p < .001$). Parameter estimates (Table 6) showed that male, and individuals who were older, with lower SES, higher on extraversion, higher on neuroticism and lower on conscientiousness reported more overall health risk behaviours. With regard to individual differences in the link between cumulative trauma and overall health risk behaviours, several effects were found, including stronger effects for individuals higher on neuroticism, older individuals and those with lower SES. With regard to gender differences, the association between cumulative trauma and health risk behaviours was found to be stronger in men than in women. Similar to the associations between the individual traumata and health risk behaviours, all effects were very small in magnitude.

4. Discussion

Using a large sample of young adults, the current study examined the links between childhood trauma and a range of health-related risk behaviours, as well as inter-individual differences in these associations. Three types of childhood trauma were distinguished: death of a loved

Table 4

Associations between childhood trauma and the young adults' health risk behaviours.

Health risk	Childhood trauma	B	SE	p	η²
Smoking	Death (not experienced)	−0.11	0.01	.000	0.001
	Sexual abuse (not experienced)	−0.49	0.02	.000	0.009
	Violence (not experienced)	−0.54	0.01	.000	0.013
Alcohol use	Death (not experienced)	0.03	0.01	.000	0.000
	Sexual abuse (not experienced)	0.13	0.02	.000	0.001
	Violence (not experienced)	−0.11	0.01	.000	0.001
Drugs use	Death (not experienced)	0.07	0.01	.000	0.000
	Sexual abuse (not experienced)	−0.60	0.02	.000	0.007
	Violence (not experienced)	−0.78	0.02	.000	0.015
Sexual risk taking	Death (not experienced)	0.07	0.01	.000	0.001
	Sexual abuse (not experienced)	−0.58	0.01	.000	0.015
	Violence (not experienced)	−0.33	0.01	.000	0.006
Accident/injury	Death (not experienced)	−0.21	0.01	.000	0.004
	Sexual abuse (not experienced)	−0.21	0.02	.000	0.001
	Violence (not experienced)	−0.57	0.01	.000	0.014

Note. 0 = reference category, e.g., reporting having experienced 'Death' is related to *more* smoking.

one, sexual abuse and violence. Although all three types were related to more risk behaviours, our findings suggest somewhat stronger and more consistent effects for interpersonal trauma (sexual abuse, violence) than for non-interpersonal trauma (death). A possible may be that these events are often more chronic, erode social support (in cases where the

Table 3b

Partial correlations between trauma and health risk variables corrected for trait and demographic characteristics.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Death (experienced)									
2. Sexual abuse (experienced)	0.06*								
3. Violence (experienced)	0.08*	0.19*							
4. Trauma total	0.95*	0.36*	0.13*						
5. Smoking	0.04*	0.11*	0.13*	0.07*					
6. Alcohol	−0.02*	−0.01	0.00	−0.02*	0.22*				
7. Drugs	0.01*	0.11*	0.11*	0.04*	0.41*	0.32*			
8. Sexual risk	0.01	0.13*	0.09*	0.05*	0.27*	0.28*	0.39*		
9. Serious accident	0.07*	0.09*	0.11*	0.09*	0.10*	0.06*	0.12*	0.12	
10. Average health risk	0.04*	0.13*	0.14*	0.08*	0.65*	0.59*	0.78*	0.62*	0.45*

Note. Correlations corrected for extraversion, conscientiousness, neuroticism, age, SES and gender.

* *p*-Values < .001.

Table 5
Associations between respectively childhood trauma, individual characteristics and their interactions, and young adults' health risk behaviour.

Model	Independent variable	B	SE	β	p
Step 1	Death (experienced)	0.03	0.01	0.01	.000
	Sexual abuse (experienced)	0.27	0.01	0.08	.000
	Violence (experienced)	0.40	0.01	0.13	.000
Step 2	Death (experienced)	0.05	0.00	0.02	.000
	Sexual abuse (experienced)	0.31	0.01	0.09	.000
	Violence (experienced)	0.28	0.01	0.09	.000
	Gender (female = 0, male = 1)	0.45	0.00	0.20	.000
	Age (higher)	0.03	0.00	0.17	.000
	SES (−3 = very low, +3 = very high)	−0.02	0.00	−0.04	.000
	Extraversion (higher)	0.31	0.00	0.25	.000
	Conscientiousness (higher)	−0.24	0.00	−0.16	.000
	Neuroticism (higher)	0.08	0.00	0.06	.000
Step 3[a]	Death (experienced)	0.04	0.01	0.02	.000
	Sexual abuse (experienced)	0.32	0.01	0.09	.000
	Violence (experienced)	0.29	0.01	0.09	.000
	Gender (female = 0, male = 1)	0.45	0.00	0.20	.000
	Age (higher)	0.03	0.00	0.17	.000
	SES (−3 = very low, +3 = very high)	−0.02	0.00	−0.04	.000
	Extraversion (higher)	0.31	0.00	0.25	.000
	Conscientiousness (higher)	−0.24	0.00	−0.16	.000
	Neuroticism (higher)	0.08	0.00	0.06	.000
	Death × gender	0.02	0.01	0.01	.016
	Death × age	0.00	0.00	0.01	.001
	Death × SES	−0.01	0.00	−0.01	.001
	Death × extraversion	0.00	0.01	0.00	.742
	Death × conscientiousness	−0.01	0.01	−0.00	.029
	Death × neuroticism	0.01	0.01	0.01	.028
Step 3[b]	Sexual abuse × gender	−0.09	0.02	−0.01	.000
	Sexual abuse × age	−0.01	0.00	−0.02	.000
	Sexual abuse × SES	−0.01	0.00	−0.01	.012
	Sexual abuse × extraversion	0.00	0.01	0.00	.861
	Sexual abuse × conscientiousness	−0.01	0.01	−0.00	.179
	Sexual abuse × neuroticism	0.07	0.01	0.02	.000
Step 3[c]	Violence × gender	0.05	0.01	0.01	.000
	Violence × age	−0.00	0.00	−0.01	.000
	Violence × SES	−0.01	0.00	−0.01	.001
	Violence × extraversion	0.03	0.01	0.01	.002
	Violence × conscientiousness	−0.01	0.01	−0.00	.597
	Violence × neuroticism	0.06	0.01	0.01	.000

Note. For step 3 the model was run three times, first for the death of a loved one interactions[a], then for the sexual abuse interactions[b], and lastly for the violence interactions[c].

Table 6
Associations between respectively cumulative childhood trauma, individual characteristics and their interactions, and young adults' health risk behaviour.

Model	Independent variable	B	SE	β	p
Step 1	Trauma (total)	0.06	0.00	0.06	.000
Step 2	Trauma (total)	0.07	0.00	0.06	.000
	Gender (female = 0, male = 1)	0.44	0.00	0.20	.000
	Age (higher)	0.04	0.00	0.18	.000
	SES (−3 = very low, +3 = very high)	−0.02	0.00	−0.04	.000
	Extraversion (higher)	0.32	0.00	0.25	.000
	Conscientiousness (higher)	−0.25	0.00	−0.17	.000
	Neuroticism (higher)	0.09	0.00	0.07	.000
Step 3	Trauma (total)	0.07	0.01	0.06	.000
	Gender (female = 0, male = 1)	0.44	0.00	0.20	.000
	Age (higher)	0.04	0.00	0.18	.000
	SES (−3 = very low, +3 = very high)	−0.02	0.00	−0.04	.000
	Extraversion (higher)	0.32	0.00	0.25	.000
	Conscientiousness (higher)	−0.25	0.00	−0.17	.000
	Neuroticism (higher)	0.09	0.00	0.01	.000
	Trauma × gender	0.01	0.01	0.01	.006
	Trauma × age	0.00	0.00	0.01	.001
	Trauma × SES	0.00	0.00	−0.01	.001
	Trauma × extraversion	0.00	0.00	0.00	.141
	Trauma × conscientiousness	−0.01	0.00	−0.01	.000
	Trauma × neuroticism	0.02	0.00	0.02	.000

perpetrator is a family member), threaten the individual's physical or psychological integrity, lead to more self-blame or other maladaptive cognitions in ways affecting daily functioning (Alisic et al., 2014; Miller, Chen, & Zhou, 2007). In contrast, whereas confrontation with death of a loved one is likely to have a profound and enduring impact, it will typically not threaten the child's integrity nor always imply a lack of safety and support in the home environment, and this may allow for better coping and faster recovery of trauma-related problems. Future research including other types of trauma (natural disaster, terrorism etc.) and more detailed information regarding the nature of the event, may clarify the importance of the social context and the extent to which traumatic events are integrity threatening. Additionally, interpersonal trauma may be more intertwined with individual characteristics such as personality traits, than exposure to death of a loved one, which in turn are related to health risk behaviours. Indeed, in our study correlations between death and the personality traits (i.e., conscientiousness, neuroticism) were weaker than between violence and sexual abuse, and the personality traits. This may point towards (shared) genetic vulnerabilities underlying both certain personality traits and sensitivity for the experience of interpersonal traumatic events (but not death or other person-independent events) (Jang, Stein, Taylor, Asmundson, & Livesley, 2003), but genetically informed designs are needed to examine this in more detail.

In line with previous studies on stress and adjustment (Forehand et al., 1998), multiple traumatic experiences had cumulative effects and were related to a larger number of health risk behaviours. These findings extend previous analyses using the current dataset showing that, in a subsample of individuals exposed to childhood sexual abuse, fewer additional traumatic experiences were positively associated with satisfaction (Whitelock et al., 2013). Findings like these underscore the importance of taking into account cumulative effects, in addition to studying the unique effects of individual events.

4.1. Individual differences in health-risk behaviour after trauma

Given the rather consistent findings regarding the specific outcomes, and to limit the number of statistical analyses, we used an aggregated health-risk measure to investigate the role of individual characteristics in the link between childhood trauma and health risk behaviours. Individual differences related to each of the traumatic experiences were assessed, as well as individual differences in the link between cumulative trauma and health risk behaviours.

First, with regard to the direct associations between the individual difference variables and health risk behaviours, men as well as individuals who were older, with lower SES, higher levels of extraversion and neuroticism and lower levels of conscientiousness reported more overall health risk behaviours. Moreover, these relations were stronger than those found between trauma and health risk behaviours, for which only small effects were found (β ranging from 0.02 to 0.09 for the individual traumatic experiences and β = 0.06 for the effect of cumulative trauma). Largest effects were found regarding the link between extraversion and health risk behaviours, which is well in line with the previous work suggesting that individuals high on extraversion engaged more in health risk behaviours such as substance use than individuals who were low on extraversion (Atherton et al., 2014).

Second, and prior to the moderation analyses, partial correlations controlling for all possible confounders were examined to disentangle direct effects of trauma on health risk behaviours, effects of trauma on health risk confounded by individual difference variables, and moderation effects of individual difference variable. Comparing findings from the bivariate and partial correlations showed that the associations between trauma and health risk were only slightly affected by the possible confounders. This indicates that there are direct relations between trauma and health risk if all confounders are held constant, that is, above and beyond possible influences of individual trait and demographic characteristics. Moreover, comparison of the bivariate and

partial correlations demonstrates that only a modest amount of variance is contributed by the moderating effects of demographic and trait characteristics.

Third, with regard to the moderating role of individual characteristics, individuals with higher levels of neuroticism reported a slightly more health risk behaviours after any of the traumatic events. Also, these individuals were slightly more sensitive to the cumulative effect of exposure to multiple traumatic events. These findings align well with the previous literature, suggesting that neuroticism signals vulnerability with respect to the impact of trauma and stress in general (Tolin & Foa, 2006). However, the retrospective nature of the study made it impossible to determine whether pre-trauma neuroticism places children at risk for lasting adverse outcomes or whether exposure to childhood trauma triggers the concurrent development of neuroticism and health-risk behaviours. Nonetheless, neuroticism is known to be quite stable over time (Caspi, Roberts, & Shiner, 2005), and environmental effects on changes in neuroticism appear to be modest (Specht, Egloff, & Schmukle, 2011). Consequently, it seems plausible that young adults with neurotic tendencies may tend to appraise trauma more negatively and have more difficulty coping adaptively, thus becoming more likely to develop health risk behaviours (Deković et al., 2008).

As far as the remaining individual characteristics were concerned, effects were inconsistent and extremely small, making it inappropriate to draw strong conclusions. However, the results with respect to SES and gender merit mentioning. Previous research did not explicitly consider SES as a moderating factor but it is now well established that trauma exposure is related to low SES (e.g., McMillen, Zuravin, & Rideout, 1995), and that low SES is associated with more health risk behaviours (Gluckman, Hanson, & Beedle, 2007). Moreover, a study of childhood trauma and chronic illness in adulthood revealed that low SES might enhance the adverse effects of childhood trauma (Mock & Arai, 2011). In the current study moderation effects were found both after the individual traumatic events, and with regard to the link between cumulative trauma and health risk. Although coefficients for these links were all modest, it might be that low SES reduces both access to counselling and treatment after trauma and more effective coping and recovery in general. With regard to gender differences, although previous studies on PTSS or internalizing problems have found women to be more vulnerable (Tolin & Foa, 2006), our findings suggest that women reported more risk behaviours after sexual abuse, while men reported more after death of a loved one and violence. Whereas women may thus be more vulnerable to the effects of trauma on internalizing behaviour, young men may be more prone to health risk behaviours. This would be consistent with previous evidence that young men engage in more risky behaviours (Bradley & Wildman, 2002), although further research is clearly needed. With regard to the role of gender in the association between cumulative trauma and health risk, stronger effects were found in men than in women. This probably mainly reflects the moderation effects found regarding the link between death (and violence) and health risk behaviours (i.e., stronger effects for men).

4.2. Limitations

Most importantly, the retrospective nature of the study precludes any conclusions regarding the direction of effects. Although it is likely that demographic characteristics and personality traits affect responses to traumatic events, the reverse could also be true (Shiner, Allen, & Masten, 2017). Relatedly, the time elapsed and current mental state of the young adults, may influence the way individuals perceive themselves (personality traits) and colour their perception of the traumatic events. Also, as time goes by, demographic and trait-characteristics may not only explain individual differences in experience of and responses to trauma, but may also set in motion sequences of individual-characteristics, traumatic experiences and risk behaviours (Moore et al., 2017). And relatedly, as people get older, they just have a higher

probably to have the chance to develop health risk behaviours (e.g., number of sexual partners). Clearly, longitudinal research including multiple waves is needed to further disentangle the long-term and potentially reciprocal associations between childhood trauma, individual-characteristics and health risk behaviours. Finally, all data were self-reported. This is a limitation, even though self-report is probably the most feasible way of studying these issues, especially in such a large sample.

4.3. General risk or individual vulnerability?

We demonstrated that exposure to death of a loved one, sexual abuse and violence during childhood is all related to a range of young adult health risk behaviours. Cumulative effects were found, suggesting that individuals may engage in a larger number of health-risk behaviours when exposed to multiple traumatic events. These findings underscore the potential impact of childhood trauma and suggest that it is crucial to identify all children exposed to childhood trauma – regardless of the nature of the event - as early as possible to encourage adaptive coping and recovery and prevent the development of health risk behaviours. With regard to the associations between individual events and health risk behaviours, effects appeared larger for sexual abuse and violence, which confirms the importance of acknowledging the varying nature of events. Finally, although several moderation effects were found, the effects were all very small, limiting the likely real-life consequences of such effects. The current study shows that large samples are indispensable when aiming at increasing our understanding of the subtle individual differences in adverse outcomes after childhood trauma, and efforts should be made to detect factors – or combinations of factors - with a more substantial prognostic value. Further big data studies will enable us to get a better grasp of the individual pathways in the aftermath of childhood trauma.

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