

# Stressful and Traumatic Life Events are Associated with Burnout—A Cross-Sectional Twin Study

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## Abstract

**Background** Most burnout studies focus on symptoms of burnout in relation to work-related stress. However, recent studies have found that familial factors and stress in the personal life may also be of importance. Stressful and traumatic life events influence how individuals cope with stress over the life course and may therefore be associated with burnout symptoms.

**Purpose** This study aims to assess the associations between stressful and traumatic life events and burnout symptoms in a population-based sample of twins, adjusting for familial confounding.

**Methods** In this cross-sectional questionnaire-based study of 25,378 Swedish twins, odds ratios (OR) with 95 % confidence intervals (CI) were calculated using logistic regression analysis. First, the whole sample was analysed. Secondly, a matched co-twin analysis was conducted of the same-sex twin pairs discordant on burnout, in order to adjust for familial factors.

**Results** A history of traumatic life events was independently associated with burnout symptoms, with a cumulative effect with increasing number of events. ORs adjusted for familial confounding: 1–3 events OR 1.58 (CI=1.21–2.07) 4 or more events OR 2.00 (CI=1.45–2.75). Independent associations between the stressful life events: serious family problems OR 1.71 (CI=1.36–2.15), physical illness OR 1.44 (CI=1.17–1.77), divorce or separation OR 1.40 (CI=1.15–1.70), and burnout symptoms were also found.

**Conclusions** The results indicate that stressful and traumatic life events are of importance in the burnout process. This finding may have implications in efforts to prevent burnout.

**Keywords** Burnout professional · Stress psychological · Life change events · Twins · Mental disorders

## Introduction

Stress at work is a known risk factor for burnout [1], but coping behaviours, as well as our individual resources, largely influence how stress affects us [2, 3]. Individuals may be able to cope with a stressful work situation; however, coping abilities may become overtaxed with the addition of a stressful or traumatic event in the personal life. Stressful and traumatic life events also affect how individuals cope with stress over the life course [4, 5]. An increased knowledge on factors such as stressful and traumatic life events and their association with burnout, and what influence these associations may be useful in when developing treatment and prevention methods for burnout.

Burnout is a non-medical term that is most often used to describe a stress reaction in people still at work. Pines and Aronson define burnout as a condition caused by long-term stress and involvement in situations that are emotionally demanding [6]. Most research in the last two decades has focused on the working population and it has defined burnout as a work-related stressful or crisis situation not necessarily requiring sick leave [7]. In a Swedish population-based study, burnout has been found to be higher in the non-working than the working population [7]. Studying burnout in an exclusively working population can lead to severe cases of burnout being overlooked, as only those with milder symptoms of burnout that are able to work are included in these studies [8]. Hence, the Burnout Measure (BM) developed by Pines et al. [9] is most suitable for studying all (and not only work-related factors) associated with burnout. The Pines BM has been found to equally well distinguish burned-out from non-burned-out subjects as the Maslach Burnout Inventory, the

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most commonly used scale to measure burnout in working populations [8].

Stress outside work such as stressful life events is common in the population, and it is not unusual for any individual to be exposed to multiple events [10]. Stressful life events are the normal difficulties and hardships encountered in life such as illness, loss, and financial misfortune, while traumatic life events are those considered to be outside the range of usual human experience and would be markedly distressing to almost anyone, such as war, torture, and rape [11]. Traumatic life events are more likely to overwhelm the individual's adaptive capabilities compared to stressful events [11]. Both stressful and traumatic life events have major impacts on both physical and mental health [12, 13] and previous research has shown that they have a direct effect on depression [14–16]. As burnout shares characteristics with depression [17–19], it is likely that stressful and traumatic life events are associated with burnout.

Stressful and traumatic life events affect health throughout the life course. Traumatic events in childhood such as abuse and neglect are associated with psychiatric disorders such as anxiety and depression in adulthood [20, 21]. It has been suggested that this link goes through neurobiological effects involving the hypothalamic-pituitary-adrenal axis, leading to cortisol dysregulation [4]. However, results have varied [22]. It is also possible that pre-existing physical characteristics predispose individuals to psychiatric disorders and burnout. For instance, a twin study found that those with small hippocampal volume were vulnerable to post traumatic stress disorder [23]. Experiencing adversities in adolescence can lead to a reduced ability to cope with job demands later in life [5]. In adulthood, having a chronically ill child [24, 25], experiencing major illness, death in the family, divorce [26], sexual assault, or severe human suffering [27] have shown associations with burnout of varied strength. Studies of specific occupational groups such as military personnel, prison guards, and care providers concluded that experiences of stressful and traumatic life events in the workplace or stress from working with trauma victims were associated with burnout [28–30]. These previous studies have only investigated a few possible stressful or traumatic life events in association to burnout. Less is known about the associations between having a history of several experiences of stressful or traumatic life events and burnout.

Burnout tends to cluster in families, indicating that familial factors (genetics and shared environment) are important in its aetiology [31–33]. Twin studies have also shown that various life events are influenced by familial factors [34–38], possibly due to socioeconomic status of the family, as stressful and traumatic life events also are more common in groups with low income and low level of education [13]. Studies have found that burnout share genetic risk factors with anxious depression [33], and that anxiety and depression have shared

genetic risk factors [39]. However, even though burnout, depression, and anxiety are conceptually close to each other, studies have shown that they are separate states with different physiological expressions [40, 41]. Moreover, personality traits such as neuroticism have a genetic component [42], found to be in common with anxiety and depression [39]. Neuroticism, anxiety, and depression are also associated with burnout [40]. It is suggested that high levels of neuroticism makes the individual more likely to end up in situations that result in negative life events [43] but also less equipped for the subsequent stress [44]. On this basis, it is possible that familial factors, depression, anxiety, and neuroticism confound the associations between stressful/traumatic life events and burnout. To the best of our knowledge, no population-based studies of stressful and traumatic life events and burnout adjusting for familial factors, depression, anxiety and neuroticism have so far been presented.

The aim of this study was to investigate if stressful and traumatic life events are associated with burnout, taking familial factors and other possible confounders into account, in a large population-based sample of Swedish twins.

## Materials and Methods

### Participants and Data Sources

Cross-sectional web-based questionnaire data was obtained from the “Study of Twin Adults: Genes and Environment (STAGE)—exposures and illnesses in middle aged twins” conducted at the Swedish Twin Registry in 2005 [45]. Twins born in 1959–1985 were asked to participate (42,582 twins) and the response rate was 59.6 %. In the current study, all respondents to the questionnaire were included. Among the 25,378 (55.6 % women, 44.4 % men) respondents, 3,553 were complete monozygotic (MZ) and 2,510 dizygotic (DZ) same-sex twin pairs. Among respondents, the mean age was 33.6 years (20–44), 773 (3.2 %) reported being unemployed and 11,383 (59.2 %) had full-time permanent employment. The mean number of years in education was 15.3 (SD 5.4) and 64.2 % were married or living with a partner. Individuals were included in the analyses regardless of working status.

### Outcome

*Burnout* was measured by using the three questions representing the three dimensions of the Pines BM; feeling depressed, being emotionally exhausted, and feeling run down [9]. The answers were on a 7-point Likert scale, where 1=do not agree and 7=agree entirely, a higher score indicated a higher level of burnout. Cronbach's alpha of the three burnout dimensions was 0.9. The three scores were added and divided by 3 to get the mean value of burnout symptoms. This 3-item

measure has been shown to have a 0.9 correlation to the 21-item BM [46]. The score 4.0 out of 7.0 was used as the cut-off for symptoms of burnout. Pines [9] stated that the 4.0 cut-off was critical for burnout and this cut-off has been used in several other studies [7, 31, 47, 48].

### Exposures

History of *traumatic life events*, during the whole life span was measured by using the Women, Co-occurring Disorders, and Violence Study (WCDVS) version of the Life Stressor Checklist revised [11]. This scale has been shown to have good measurement properties with means centred within the range (mean 16.32, range 2–30) and temporal stability, with test and retest intra class coefficient of 0.88 [11]. The 15 events were added into a summary variable using follow-up questions to quantify how often an event had occurred (1=once, 2=a few times, and 3=often) using the same procedure as recommended by the authors to the WCDVS [11]. Cronbach's alpha for the traumatic life events was acceptable at 0.71. A categorical variable was also created; cut-off points for the levels of the categorical variables were based on the distribution of the data and three groups were formed with as equal number of subjects in each group as possible. The three levels were 0, 1–3, and 4+ events and the first (those that had no traumatic events) was used as the reference group.

Twenty-one *stressful life events* were also included, based on a revised version of the life stressor checklist [49], in which, respondents indicate if they had ever, during their whole life span, experienced the event or not. There were no follow-up questions regarding how often the events had occurred; hence, the events were analysed as separate events, and no summary variable was created.

### Confounders

*Age* was used as a continuous variable in the analyses, *sex* was a dichotomous variable, and *zygosity* was determined by questions regarding twin pair similarity [45]. To place the participants in six *socioeconomic status* groups (*SES*), the question “what type of profession/job do you have now or when you were last active in the labour market?” was used [50] (Table 1). *Depression* (major depressive disorder (MDD)) and *anxiety* (generalised anxiety disorder (GAD)) was measured using questions based on criteria in the Diagnostic and Statistical Manual of mental disorders, fourth version [51]. In the STAGE questionnaire, 38 questions assessed depression and 23 assessed anxiety. Binary variables were created based on whether a person met the diagnostic criteria for MDD or GAD. *Neuroticism* was measured with the nine items from the short-form of the Eysenck Personality Inventory [52] and nine additional items included in the STAGE study from the full Eysenck form [53]. Adding these items

provided a better (normal) distribution of the neuroticism scale. The score was based on the sum of “yes” responses to the 18 neuroticism items.

### Statistical Analysis

To determine if differences between those with high and low burnout scores were statistically significant, *t* tests and chi-square tests were performed. Spearman's correlations were calculated between the continuous traumatic life event summary variable and Pines BM and between all confounders. Chi-square test for trend was conducted to assess whether burnout (dichotomous) varied linearly through levels of traumatic life events. Answers “do not know”/“do not want to answer” were treated as missing values.

Logistic regression analyses of the whole sample were performed to assess odds ratios (OR), with 95 % confidence intervals (CI), for associations between stressful/traumatic life events and Pines BM. Those that did not report any events were included as the reference group; the same applies for those with a burnout score below 4.0. The clustered robust (clustered on twin pair identification number) standard error was used to account for the non-independence between twins in a pair. ORs were calculated between each separate life event and burnout. These models were adjusted in three steps: firstly for the demographic variables sex, age, and SES (model 1). Secondly, adding neuroticism, anxiety and depression (model 2). Thirdly, life events were also added into the same model, i.e. adjusting for all other life events (model 3). A regression model was also built for the total number of traumatic life events and burnout.

Analyses of complete same-sex twin pairs discordant for burnout (co-twin control) using conditional logistic regression were conducted for the analyses of total number of traumatic life events and for the stressful and traumatic life events separately. The conditional analysis adjusts for the factors shared between the twins in a pair, which is shared environment and 100 % genetics for MZ twins and 50 % of genetics for DZ twins. Utilising a sample of same-sex twins not only allows control for age but also for sex. The presence of familial confounding is suspected if ORs are lower in the co-twin analysis [54]. The co-twin analysis was stratified on zygosity. However, due to similar directions and magnitudes of the estimates for MZ and DZ twins, the co-twin results are presented for MZ and DZ twins combined in the tables. All statistical analyses were performed using STATA IC/12.1.

### Ethics

The study of burnout using STAGE data was approved by the regional ethics committee board in Stockholm, Sweden (Dnr: 2009/2053-31/5. Date: 11/02/2010).

**Table 1** Frequencies (percentages) of exposures and covariates in the Swedish twin sample, stratified for high (4 or above) and low (less than 4) burnout scores ( $N=25,378$ )

Variable	All <i>n</i> (%)	High burnout <i>n</i> (%)	Low burnout <i>n</i> (%)
Total sample	25,378 (100)	4,306 (100)	17,715 (100)
Sex			
Men	11,264 (44.4)	1,131 (26.3)	8,405 (47.4)
Women	14,114 (55.6)	3,175 (73.7)	9,310 (52.6)
Age (mean, 20–46)	33.6 (SD)	34.0 (SD 7.6)	33.6 (SD 7.7)
Socio-economic status group			
Manual employees in goods production	2,916 (11.5)	354 (8.2)	2,259 (12.8)
Manual employees in service production	5,391(21.2)	1,037 (24.1)	3,813 (21.5)
Non-manual employees lower level	2,674(10.5)	524 (12.2)	1,850 (10.4)
Non-manual employees, intermediate level	4,590 (18.1)	780 (18.1)	3,365 (19)
Non-manual higher level	2,757(10.9)	487 (11.3)	1,968 (11.1)
Self employed	357(1.4)	55 (1.3)	251 (1.4)
Missing	6,693(26.4)	1,069 (24.8)	4,209 (23.8)
Personality factors			
Neuroticism (mean score, 1–18)	5.2 (SD 4.2)	9.2 (SD 4.4)	4.1 (SD 3.5)
Depression			
Yes	2,821 (11.1)	1,577 (36.6)	1,212 (6.8)
No	18,948 (74.7)	2,538 (58.9)	16,157 (91.2)
Missing	3,609 (14.2)	191 (4.4)	346 (2)
Anxiety			
Yes	935 (3.7)	528 (12.3)	399 (2.3)
No	18,310 (72.1)	2,389 (55.5)	15,692 (88.6)
Missing	6,133 (24.2)	1,389 (32.3)	1,624 (9.2)

## Results

### Descriptive Analysis

One fifth of the respondents had symptoms of burnout, i.e. a score above 4.0 of the Pines BM. This was more than twice as common among the women compared to the men (Table 1). Among those with a score of 4.0 or higher on the Pines BM, depression and anxiety were five times more common than among those with a lower score. Further, individuals with symptoms of burnout scored higher on neuroticism. Experiencing stressful life events was common in this sample (Table 2).

### Association between Stressful Life events and Burnout

In the crude analysis of the whole sample, all but two of the stressful life events were associated with burnout. However, when adjusted for all confounders and all other stressful life events, serious family problems, physical illness, divorce or

separation, and child died, remained significantly associated with burnout (Table 2).

In the co-twin analysis, serious family problems, physical illness, lost a friendship, divorce or separation, leisure activity stopped, and parents divorced (while living with them), were still significantly associated with burnout hence independent of familial factors (Table 2). Results showed that serious family problems, physical illness, and divorce or separation were independently associated with burnout, i.e., still significant after adjusting for both familial and other confounders.

### Association between Traumatic Life Events and Burnout

All 15 traumatic life events were associated with burnout in the crude analyses. However, in the model adjusted for confounders and all other traumatic life events (model 3, Table 3), being emotionally abused or neglected and other upsetting or stressful events remained significantly associated with burnout. The summary variable including all traumatic life events was correlated with burnout ( $r=0.25$ ,  $p<0.01$ ). The ORs for burnout were higher when more than zero traumatic life

**Table 2** Odds ratios (OR) with 95 % confidence intervals (CI) for the associations between stressful life events and burnout

Stressful life event	Number	Crude OR (95 % CI)	Model 1 OR (95 % CI)	Model 2 OR (95 % CI)	Model 3 OR (95 % CI)	Co-twin model OR (95 % CI)
Serious family problems	4,525	<b>2.61</b> (2.41–2.82)	<b>2.54</b> (2.31–2.78)	<b>1.57</b> (1.38–1.79)	<b>1.38</b> (1.19–1.60)	<b>1.71</b> (1.36–2.15)
Physical illness	3,847	<b>2.03</b> (1.87–2.20)	<b>2.01</b> (1.83–2.22)	<b>1.41</b> (1.23–1.62)	<b>1.30</b> (1.12–1.52)	<b>1.44</b> (1.17–1.77)
Lost a friendship	8,578	<b>2.00</b> (1.86–2.15)	<b>1.94</b> (1.78–2.12)	<b>1.24</b> (1.09–1.40)	1.06 (0.92–1.22)	<b>1.53</b> (1.26–1.86)
Moved to worse home or neighbourhood	2,372	<b>1.93</b> (1.75–2.12)	<b>2.01</b> (1.80–2.26)	<b>1.20</b> (1.01–1.43)	0.99 (0.82–1.20)	1.16 (0.91–1.49)
Financial loss	2,834	<b>1.83</b> (1.67–2.01)	<b>2.05</b> (1.84–2.29)	<b>1.31</b> (1.12–1.54)	1.08 (0.90–1.30)	1.25 (0.97–1.61)
Divorce or separation	8,391	<b>1.72</b> (1.60–1.86)	<b>1.78</b> (1.63–1.95)	<b>1.39</b> (1.23–1.57)	<b>1.28</b> (1.12–1.46)	<b>1.40</b> (1.15–1.70)
Problems with the neighbours	2,170	<b>1.68</b> (1.52–1.86)	<b>1.67</b> (1.48–1.88)	<b>1.22</b> (1.02–1.46)	1.07 (0.89–1.30)	1.15 (0.88–1.50)
Adopted or placed in foster care	402	<b>1.66</b> (1.33–2.06)	<b>1.61</b> (1.24–2.11)	1.02 (0.68–1.55)	0.78 (0.51–1.19)	0.60 (0.22–1.65)
Partner died	194	<b>1.65</b> (1.21–2.26)	1.35 (0.94–1.94)	1.12 (0.65–1.93)	0.95 (0.54–1.68)	0.85 (0.38–1.89)
Child died	402	<b>1.60</b> (1.29–2.00)	1.24 (0.97–1.59)	<b>1.45</b> (1.01–2.08)	<b>1.48</b> (1.02–2.13)	1.72 (0.96–3.08)
Leisure activity stopped	6,883	<b>1.46</b> (1.36–1.57)	<b>1.55</b> (1.42–1.70)	1.11 (0.98–1.25)	0.92 (0.80–1.05)	<b>1.54</b> (1.27–1.87)
Involved in a trial or court case	2,690	<b>1.44</b> (1.31–1.59)	<b>1.66</b> (1.48–1.85)	<b>1.22</b> (1.04–1.44)	1.03 (0.86–1.23)	1.29 (0.99–1.69)
Parents divorced (while living with them)	4,294	<b>1.42</b> (1.30–1.54)	<b>1.41</b> (1.27–1.55)	<b>1.22</b> (1.06–1.40)	1.06 (0.91–1.23)	<b>2.05</b> (1.23–3.41)
Lost a job	5,301	<b>1.40</b> (1.30–1.52)	<b>1.53</b> (1.40–1.68)	<b>1.15</b> (1.01–1.31)	1.02 (0.89–1.17)	0.96 (0.78–1.18)
Close family member got sick or seriously injured	8,037	<b>1.39</b> (1.29–1.49)	<b>1.34</b> (1.23–1.46)	<b>1.17</b> (1.03–1.32)	1.05 (0.92–1.20)	1.17 (0.93–1.47)
A close friend died	3,355	<b>1.37</b> (1.26–1.50)	<b>1.43</b> (1.29–1.59)	<b>1.29</b> (1.11–1.50)	1.18 (1.00–1.39)	1.00 (0.77–1.30)
Other close family member (than child or partner) died	10,654	<b>1.20</b> (1.11–1.29)	1.08 (0.99–1.18)	1.07 (0.94–1.22)	0.98 (0.85–1.12)	1.17 (0.93–1.47)
Lost home to natural disaster	100	1.25 (0.80–1.97)	1.05 (0.63–1.76)	0.74 (0.30–1.82)	0.62 (0.25–1.52)	0.63 (0.20–1.91)
Involved in an accident	4,423	<b>1.18</b> (1.08–1.28)	<b>1.37</b> (1.25–1.51)	<b>1.25</b> (1.09–1.43)	1.12 (0.95–1.31)	1.06 (0.86–1.32)
Injury	6,220	<b>1.17</b> (1.09–1.27)	<b>1.42</b> (1.29–1.55)	<b>1.16</b> (1.02–1.32)	0.91 (0.78–1.06)	1.08 (0.89–1.31)
Directly affected by the tsunami 2004	1,163	1.10 (0.95–1.27)	1.06 (0.90–1.26)	1.26 (1.00–1.58)	1.17 (0.93–1.48)	1.00 (0.64–1.57)

Model 1: adjusted for sex, age and socio-economic status, no event is reference

Model 2: adjusted for sex, age, socio-economic status, depression, anxiety and neuroticism

Model 3: adjusted for sex, age, socio-economic status, depression, anxiety, neuroticism and all other stressful life events in the table

Co-twin model: analysis of complete same-sex twin pairs discordant for the outcome, hence adjusted for sex, age and familial factors by matching

events were reported and the ORs show a cumulative pattern (Linear-by-Linear Association 550.10,  $p < 0.01$ ) (Table 4).

In the matched co-twin control analysis, there was a reduction in OR compared to the results of the whole sample (Table 4). However, the association from the co-twin analysis was still significant. This indicates that there is an association between a history of traumatic life events and burnout independent of familial factors. Stratifying the analysis on zygosity showed MZ twins had an OR of 2.10 (CI=1.34–3.30) for more than four traumatic life events and the corresponding OR for DZ twins was 1.92 (CI=1.21–3.05). Hence, ORs were in the same direction and of similar magnitude for MZ and DZ twins.

## Discussion

In the present population-based twin study, burnout was independently associated with serious family problems, physical illness, and divorce or separation (stressful life events).

Furthermore, burnout was found to be associated with emotional abuse or neglect, other upsetting or stressful events, and a history of traumatic life events. These results add to the burnout literature that mainly focuses on stress at work. A cumulative pattern was observed with higher ORs for burnout when exposed to a higher number of traumatic life events. Familial factors may influence this pattern but a significant association remained in the co-twin analysis. This suggests that familial factors do not fully explain the association. In the more severe cases of clinical burnout, this may have treatment implications as the underlying traumatic experiences may need to be addressed in the treatment. In Sweden, sick leave due to stress-related mental diagnoses including clinical burnout is common [55] and stress-related sick leave has also increased in other northern European countries in the last decade [56–58].

In the present study, associations between traumatic life events and burnout were somewhat reduced after adjustment for familial factors. Possibly, the same familial factors that put individuals at risk for burnout may also put individuals at risk

**Table 3** Odds ratios (OR) with 95 % confidence intervals (CI) for the associations between traumatic life events and burnout

Traumatic life event	Number	Crude OR (95 % CI)	Model 1 OR (95 % CI)	Model 2 OR (95 % CI)	Model 3 OR (95 % CI)	Co-twin model OR (95 % CI)
Physical violence between family members	3,323	<b>1.92</b> (1.76–2.10)	<b>1.93</b> (1.74–2.14)	<b>1.29</b> (1.11–1.49)	0.97 (0.80–1.16)	1.34 (1.00–1.80)
Emotionally abused or neglected	6,977	<b>3.01</b> (2.79–3.25)	<b>2.85</b> (2.61–3.12)	<b>1.57</b> (1.39–1.78)	<b>1.37</b> (1.19–1.58)	<b>1.66</b> (1.35–2.03)
Physically neglected	684	<b>3.14</b> (2.67–3.69)	<b>3.08</b> (2.55–3.74)	<b>1.88</b> (1.44–2.45)	1.26 (0.93–1.72)	<b>1.89</b> (1.09–3.30)
Robbed, beaten or attacked by someone you did not know	2,819	<b>1.12</b> (1.01–1.23)	<b>1.56</b> (1.39–1.76)	<b>1.24</b> (1.05–1.48)	1.07 (0.88–1.29)	1.03 (0.79–1.34)
Witnessed a robbery, attack or similar	3,023	<b>1.16</b> (1.06–1.28)	<b>1.53</b> (1.36–1.72)	<b>1.38</b> (1.18–1.63)	1.19 (0.99–1.42)	1.11 (0.85–1.44)
Stalked or threatened	2,644	<b>2.04</b> (1.86–2.24)	<b>2.13</b> (1.91–2.38)	<b>1.39</b> (1.17–1.64)	1.06 (0.88–1.28)	<b>1.55</b> (1.19–2.01)
Body searched or held against your will by health care personnel	563	<b>1.99</b> (1.66–2.38)	<b>2.34</b> (1.87–2.95)	1.05 (0.73–1.53)	0.85 (0.55–1.30)	1.10 (0.67–1.78)
Discriminated against	1,138	<b>2.32</b> (2.04–2.64)	<b>2.19</b> (1.87–2.57)	<b>1.40</b> (1.11–1.77)	1.05 (0.80–1.38)	1.10 (0.78–1.56)
Victim of hate crime	224	<b>2.71</b> (2.07–3.54)	<b>3.30</b> (2.37–4.60)	<b>1.78</b> (1.05–3.01)	1.17 (0.65–2.10)	<b>2.78</b> (1.30–5.95)
Sexual harassment	2,308	<b>2.54</b> (2.31–2.80)	<b>2.14</b> (1.91–2.40)	<b>1.42</b> (1.20–1.68)	1.20 (0.99–1.45)	1.16 (0.91–1.48)
Sex against your will in exchange for money, narcotics or other	83	<b>5.26</b> (3.37–8.21)	<b>4.43</b> (2.54–7.72)	2.15 (0.97–4.77)	1.54 (0.54–4.42)	1.14 (0.41–3.15)
Forced to have sex	960	<b>3.35</b> (2.92–3.84)	<b>2.49</b> (2.11–2.93)	<b>1.36</b> (1.06–1.74)	1.02 (0.75–1.38)	<b>1.61</b> (1.16–2.22)
Forcibly touched or forced to touch in a sexual way	1,252	<b>2.94</b> (2.60–3.32)	<b>2.29</b> (1.98–2.64)	<b>1.46</b> (1.18–1.79)	1.06 (0.82–1.38)	<b>1.69</b> (1.19–2.41)
Physically abused by someone you knew	2,541	<b>2.55</b> (2.32–2.80)	<b>2.35</b> (2.10–2.62)	<b>1.42</b> (1.20–1.67)	1.06 (0.86–1.30)	<b>1.59</b> (1.21–2.09)
Other upsetting or stressful events	1,105	<b>2.83</b> (2.49–3.21)	<b>2.62</b> (2.26–3.04)	<b>1.58</b> (1.24–2.00)	<b>1.38</b> (1.08–1.77)	<b>1.66</b> (1.19–2.29)

Model 1: adjusted for sex, age and socio-economic status, no event is reference

Model 2: adjusted for sex, age, socio-economic status, depression, anxiety and neuroticism

Model 3: adjusted for sex, age, socio-economic status, depression, anxiety, neuroticism and all other traumatic life events in the table

Co-twin model: Analysis of complete same-sex twin pairs discordant for the outcome, hence adjusted for sex, age and familial factors by matching

for experiencing negative events, such as genetically influenced personality traits, for example, risk taking or impulsiveness, and shared environmental factors for example social class. Social class is indeed associated with both the amount of stressful life events an individual experiences as well as with psychological distress and mental disorders, such as depression [13]. Previous research has found that both burnout and exposure to life events are influenced by familial factors [34–38, 59, 60]. Hence, as expected, familial factors explain

part of the associations found. However, it should be noted that when adjusting for sex, age, SES, depression, anxiety, and neuroticism, the ORs were also reduced to a larger extent than in the co-twin analysis. This indicates that these factors may be of greater importance than familial factors in explaining the association between life events and burnout. Additionally, the reduction of the ORs in the co-twin analysis may be a reflection of these factors. However, as associations still remained, the results from this study suggest independent associations

**Table 4** Crude and adjusted odds ratios (OR) with 95 % confidence intervals (CI) of the association between number of traumatic life events ( $N=15,276$ ) and burnout

	Crude OR OR (95 % CI)	Model 1 OR (95 % CI)	Model 2 OR (95 % CI)	Model 3 OR (95 % CI)	Co-twin model OR (95 % CI)
Number of traumatic life events					
0	1	1	1	1	1
1–3	<b>1.81</b> (1.62–2.01)	<b>1.90</b> (1.70–2.11)	<b>1.80</b> (1.59–2.04)	<b>1.29</b> (1.09–1.51)	<b>1.58</b> (1.21–2.07)
4 or more	<b>3.36</b> (3.02–3.74)	<b>3.46</b> (3.11–3.85)	<b>3.29</b> (2.91–3.73)	<b>1.61</b> (1.36–1.91)	<b>2.00</b> (1.45–2.75)

Model 1: adjusted for sex and age

Model 2: adjusted for sex, age and socio-economic status

Model 3: adjusted for sex, age, socio-economic status, depression, anxiety and neuroticism

Co-twin model: analysis of complete same sex twin pairs discordant for the outcome, hence adjusted for sex, age and familial factors by matching

Model 1–3: results of the analysis of the whole sample. Co-twin model: conditional logistic regression analysis of the associations between traumatic life events and burnout for the complete same-sex twin pairs discordant for burnout ( $n=1438$ )

between stressful and traumatic life events and burnout. It is also possible that shared environment between the twins in a pair includes stressful or traumatic life events that may have an effect on burnout. Hence, the effect of familial factors found in this study does not exclude the possibility of an association of these events and burnout. Also, as the current study adjusted for many confounders including depression, anxiety and neuroticism, it is unlikely that these associations have been overestimated. If anything, they may thus be underestimated.

In a previous study, stressful life events have been found to be strongly associated with the onset of depression [14]. Since depression and burnout share characteristics [17–19], it is possible that there may be a direct effect of stressful and traumatic life events on burnout. However, as this study is cross-sectional, such conclusions cannot be drawn. Moreover, as it could not be established where in the burnout process these life events were of importance this needs to be further investigated for more knowledge of the direction in the association between life events and burnout.

Symptoms of burnout were common in the sample with almost 20 % having a score of 4.0 or above on the Pines BM. This should not be interpreted as 20 % of the population being ‘burned out,’ but should instead be interpreted with caution as the Pines BM is not a clinical tool but rather a scale measuring the level of exhaustion in the population. Moreover, it is common to use 4.0 as the cut-off for burnout [7, 31, 51, 52], but this cut-off has not been validated. In a recent study, a burnout prevalence of 13 % was found in the general working population using the Shirom-Melamed Burnout Questionnaire [61]. The high prevalence of burnout symptoms in the present study may be due to the fact that participants who presently were on sick leave, disability pension, or unemployed were not excluded. It has been suggested that many burnout studies suffer from the “healthy worker effect,” as it excludes those individuals whose symptoms of burnout are so severe, that they can no longer work [8]. The high prevalence might also be due to the young age of the participants, as a recent meta-analysis found that burnout usually decreases with age [62], however, a population-based study which included also non-working individuals found a weak association between age and burnout [7]. The prevalence of burnout was more than twice as high among women compared to men, in line with another population-based study from Sweden [7].

Limitations of this study include its cross-sectional design. To confirm that stressful or traumatic life events increase the risk for burnout, longitudinal studies are needed. This study was based on data from the population-based Swedish Twin Registry; hence results should be generalised for the population at large. However, whether twins are more likely to develop burnout is unknown. Middeldorp et al. [38] found no difference in negative life events between twins and singletons. The somewhat low response rate and the fact that the Swedish twin registry only contains twins born in Sweden

may also affect the generalizability. Strengths in the present study include: the large sample size, the use of validated instruments, the inclusion of several covariates, and the possibility to adjust for familial confounding by using twin data.

To conclude, this study found that a history of traumatic life events was associated with burnout. A cumulative effect was found; with the associations increasing in strength the more traumatic life events had occurred. The association also remained after adjustments for familial factors and other confounders. The traumatic life events being emotionally abused or neglected and other upsetting events were independently associated with burnout. Stressful life events were also associated with burnout; after adjustments for familial and other confounders, serious family problems, physical illness and divorce or separation were independently associated with burnout. The results indicate that stressful and traumatic life events may be of importance in the burnout process. This finding may have treatment implications and warrants further investigations.

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