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CLINICAL RESEARCH ARTICLE



The mediating role of COVID-19-related burden in the association between adverse childhood experiences and emotional exhaustion: results of the egePan – VOICE study

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ABSTRACT

Background: Adverse childhood experiences (ACEs) increase the risk for mental health problems. However, there is a lack of data targeting the role of ACEs for one of the most prevalent mental health problems in health-care professionals: burnout.

Objective: We aimed to assess the relationship between ACEs and the core burnout dimension 'emotional exhaustion' (EE). As health-care professionals have been facing particular challenges during the COVID-19 pandemic, we furthermore aimed to assess the role of COVID-19 associated burden in the interplay between ACEs and EE.

Methods: During the first lockdown in Germany, a total of 2500 medical healthcare professionals were questioned in a cross-sectional online survey. Questions targeted, among others, sociodemographics, ACEs, COVID-19-associated problems (e.g. increase of workload, worries about relatives and patients) and emotional exhaustion, measured by the respective dimension of the Maslach Burnout Inventory (MBI).

Results: In German health-care professionals, ACEs were associated with a higher EE score. The number of experienced ACEs was associated with the majority of assessed COVID-19-associated problems. An increasing number of ACEs predicted higher EE scores, controlling for gender. The association between ACEs and EE was mediated significantly by COVID-19-associated problems. These included maladaptive coping strategies such as increased smoking, drinking and use of antidepressants/tranquilizers, feeling less protected by measures of the employee or the state, a greater feeling of being burdened by COVID-19-associated problems and greater exhaustion and sleep problems.

Conclusion: Our findings suggest ACEs as significant risk factor for EE in German health-care professionals. The current pandemic means a significant burden that further pronounces this risk.

El papel mediador de la carga relacionada con COVID-19, en la asociación entre las experiencias adversas de la infancia y el agotamiento emocional: resultados del estudio egePan - VOICE

Antecedentes: Las experiencias adversas en la niñez (ACEs en sus siglas en inglés) aumentan el riesgo de problemas de salud mental. Sin embargo, faltan datos sobre el papel de las ACEs en uno de los problemas de salud mental más prevalentes en los profesionales de la salud: el agotamiento (burnout).

Objetivo: Nuestro objetivo fue evaluar la relación entre las ACEs y la dimensión central del agotamiento 'agotamiento emocional' (AE). Dado que los profesionales de la salud se han enfrentado a desafíos particulares durante la pandemia de COVID-19, además nos propusimos evaluar el papel de la carga asociada a COVID-19 en la interacción entre las ACEs y la AE.

Métodos: Durante la primera cuarentena en Alemania, se interrogó a un total de 2500 profesionales de la salud en una encuesta transversal en línea. Las preguntas fueron dirigidas, entre otros, a datos sociodemográficos, ACEs, problemas asociados a COVID-19 (por ejemplo, aumento de la carga de trabajo, preocupaciones sobre familiares y pacientes) y agotamiento emocional, medidos por la dimensión respectiva del Maslach Burnout Inventory (MBI).

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PALABRAS CLAVES

Experiencias adversas en la niñez (ACEs); COVID-19; pandemia; agotamiento emocional; agotamiento; profesionales de la salud

关键词

不良童年经历 (ACE); COVID-19; 流行病; 情绪疲惫; 倦怠; 医疗保健专业人员

HIGHLIGHTS

- Adverse childhood experiences (ACEs) predicted higher scores of emotional exhaustion (EE) in German healthcare professionals during the COVID-19 pandemic.
- COVID-19 associated problems mediated the association between ACEs and EE.
- COVID-19 and ACEs add to the risk of EE in healthcare professionals.

Resultados: En los profesionales sanitarios alemanes, las ACEs se asociaron con una puntuación de AE más alta. El número de ACEs experimentados se asoció con la mayoría de los problemas asociados a COVID-19 evaluados. Un mayor número de ACEs predijo puntuaciones de AE más altas, controlado por género. La asociación entre ACEs y AE fue mediada significativamente por problemas asociados con COVID-19. Estos incluyeron estrategias de afrontamiento desadaptativas, como fumar, beber y usar antidepresivos/tranquilizantes, sentirse menos protegido por las medidas del empleador o el estado, una mayor sensación de estar agobiado por los problemas asociados con COVID-19 y un mayor agotamiento y problemas de sueño.

Conclusión: Nuestros hallazgos sugieren que las ACEs son un factor de riesgo significativo para la AE en los profesionales de la salud alemanes. La pandemia actual implica una carga importante que acentúa aún más este riesgo.

COVID-19 相关负担在不良童年经历与情绪衰竭关系中的中介作用: egePan - VOICE 研究的结果

背景: 不良童年期经历 (ACE) 会提高心理健康问题的风险。但是, 缺乏针对 ACE 在医疗保健专业人员中最普遍的心理健康问题之一——倦怠中作用的数据。

目的: 我们旨在评估 ACE 与核心倦怠维度‘情绪耗竭’(EE) 之间的关系。由于医疗保健专业人员在 COVID-19 疫情期间面临特殊挑战, 因此我们还旨在评估 COVID-19 相关负担在 ACE 和 EE 之间相互作用中的作用。

方法: 在德国首次封锁期间, 在一项横断面在线调查中询问了总共 2500 名医疗保健专业人员。问题针对由 Maslach 倦怠量表 (MBI) 的各个维度测量的社会人口统计学, ACE, COVID-19 相关问题 (例如工作量增加, 对亲属和患者的担忧) 和情绪耗竭等。

结果: 在德国医疗保健专业人员中, ACE 与较高的 EE 评分相关。经历 ACE 数量与大多数评估的 COVID-19 相关问题有关。控制性别后, 增多的 ACE 预测了更高的 EE 分数。COVID-19 相关问题显著中介了 ACE 和 EE 之间的关联。其中包括适应不良的应对策略, 例如增加吸烟, 饮酒和使用抗抑郁药/镇静剂, 感觉受到员工或国家措施的保护较少, 感觉到 COVID-19 相关问题负担更大, 以及更严重的疲劳和睡眠问题。

结论: 我们的研究结果表明 ACE 是德国医疗保健专业人员 EE 的重要风险因素。当前的疫情意味着沉重的负担, 进一步凸显了这一风险。

1. Introduction

The pandemic due to the severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (COVID-19 pandemic) has profoundly affected people around the world during the last year. However, the psychological strain of the pandemic has been diverging for different groups of the population and health-care professionals have particularly been affected (Pappa et al., 2020).

Health-care professionals have been faced with significant burdens during the pandemic: being a central part in the fight against COVID-19 and belonging to the critical infrastructure, many were confronted with the reorganization of their work structure, had to work under changed conditions and in different teams, going along with increased occupational stress. Workload has been enhanced substantially. Many have been at increased risk for an infection with SARS-CoV-2 and were exposed to the death of numerous patients. To date, several studies confirm a high burnout risk in health-care professionals during the pandemic (Dimitriu et al., 2020; Sharifi, Asadi-Pooya, & Mousavi-Roknabadi, 2021).

Burnout is defined as severe distress strongly associated with stressful working conditions and organizational structures. Emotional Exhaustion (EE), the affective component of the Maslach burnout construct, is considered the core dimension of burnout (Maslach, Schaufeli, & Leiter, 2001) and is specifically

influenced by occupational stress (Wang et al., 2014; Weigl, Schneider, Hoffmann, & Angerer, 2015). Research data suggest that healthcare professionals have already been at high risk for burnout before the COVID-19 pandemic (Martini, Arfken, Churchill, & Balon, 2004). This, in turn, has been shown to result in an increased risk for medical errors in healthcare professionals and decreased patient satisfaction with patient-physician interaction (Montgomery et al., 2021; Patel, Bachu, Adikey, Malik, & Shah, 2018; Wang et al., 2014; Weigl et al., 2015). Healthcare professionals with burnout are at higher risk for disruptive behaviour (Brown, Goske, & Johnson, 2009) and suicidal thoughts (van der Heijden, Dillingh, Bakker, & Prins, 2008).

While well-known risk factors for the development of burnout comprise e.g. female gender, younger age and working in the emergency department (Kansoun et al., 2019; Zhou et al., 2020), adverse childhood experiences (ACEs) may be a yet underestimated risk factor. In a recent study, the number of experienced types of ACEs was associated with a more than two-and-a-half fold increased risk for burnout in health-care professionals (Yellowlees, Coate, Misquitta, Wetzel, & Parish, 2021). More studies on the association between ACEs and EE in healthcare professionals are lacking. However, an association between the number of experienced ACEs and burnout was

shown before among Nursing students (McKee-Lopez, Robbins, Provencio-Vasquez, & Olvera, 2019) and mental health providers (La Mott & Martin, 2019). ACEs can be divided into child maltreatment, in detail physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect, and household dysfunctions, including substance abuse and mental illness of a family member, intimate partner violence between parents, incarceration of a family member and disappearance of a parent through divorce, death or other reason (Felitti et al., 1998). ACEs are associated with psychosocial and economic impairments across the lifespan, a significant reduction in quality of life, and an increased risk for somatic and mental health problems including suicide attempts (Clemens et al., 2018; Felitti et al., 1998; Janiri et al., 2018; Norman et al., 2012; Rehkopf et al., 2016). Importantly, childhood adversity is associated with an increased neural response to signals of threat (Hein & Monk, 2017), increased emotional reactivity and impaired emotion regulation (Duffy, McLaughlin, & Green, 2018). Consequently, the current pandemic may be a particular burden for persons who have experienced ACEs.

Hence, the aim of the current study was to examine whether ACEs are contributing factors to increased burnout symptomatology during the COVID-19 pandemic among German healthcare professionals. We hypothesized that healthcare professionals with ACEs are at higher risk for EE and are more burdened by the pandemic. Furthermore, we aimed to investigate whether childhood adversities differentially predict EE and whether COVID-19 related burden mediates the association between ACEs and EE. To investigate these hypotheses, we analysed cross-sectional data assessed as part of the web-based VOICE survey during the first wave of the COVID-19 pandemic. This study was conducted within the German cooperation network of university medicine (NUM) by the German Federal Ministry of Education and Research.

2. Methods

2.1. Study design

The present study results are part of the online study VOICE, which was conducted within the framework of the egePan Unimed project 'Development, testing and implementation of regionally adaptive care structures and processes for evidence-led pandemic management coordinated by university medicine'. The task of the egePan Unimed project is to review and coordinate pandemic management concepts in Germany and internationally, to evaluate their practicability using scientific methods and to integrate them into a framework plan. The overarching goals are adequate resource management within a region to

avoid inefficient use of intensive care and care capacities in the inpatient sector, and consensus-based patient management also for non-hospitalized patients. While the core questions of the VOICE survey were the same for all, each university had the opportunity to add special questions into their survey. The team at the University of Ulm added questions regarding adverse childhood experiences. Therefore, only the subsample of VOICE who answered the Ulmer survey were included into this analysis.

The cross-sectional self-report online survey was conducted using the platform Unipark and was available from mid of April until end of June 2020. Information about the survey was provided through different ways such as social media platforms like Facebook, Twitter, Medscape, coliquio, etc., private contacts, invitations of different clinics, professional associations and so on. The online survey comprised 110 items. Inclusion criteria were defined as a minimum age of 18 years, working in the health care sector, residence/working place in Germany, as well as sufficient German language skills.

2.2. Ethics

Information on the study and data analysis were given prior to the study. Electronic informed consent was obtained from each participant before the start of the survey. Participation was anonymous and participants could withdraw from the survey at any time. The study was conducted in accordance with the Declaration of Helsinki. After consultation with the ethics committee of the University of Ulm, there was no requirement for an ethics vote due to the anonymous character of the study.

2.3. Measures

Socio-demographic questions covered among others' age, gender and profession. Pandemic-associated questions to assess the psychological impact have already been used in healthcare professionals during the H1N1 pandemic in 2009 (Matsuishi et al., 2012). Items referred to the time frame of the last two weeks and were answered on a 4-point Likert scale from 0 = "strongly disagree" to 4 = 'strongly agree'.

Adverse childhood experiences were assessed using the German version of the Adverse Childhood Experiences Questionnaire, a standard tool for the retrospective assessment of ACEs (Felitti et al., 1998). The German version of the questionnaire has a satisfactory reliability (Cronbach's $\alpha = 0.76$), the coefficients of discrimination lay between 0.30 and 0.65 due to the fact that each item asks about a different dimension of ACEs (Wingenfeld et al., 2011). A sum score between 0 and 10 can be

calculated, meaning that a participant has experienced between 0 and all of 10 assessed forms of ACEs.

The Maslach Burnout Inventory (MBI) (Maslach, Jackson, & Leiter, 1996; Maslach, Jackson, Leiter, Schaufeli, & Schwab, 1986) is the gold standard to measure burnout. The only German version of the MBI authorized by Maslach (MBI-D) was used (Büssing & Perrar, 1992; Burisch, 2010). The MBI-D consists of 21 items and contains the three dimensions of burnout: emotional exhaustion (MBI-EE) (9 items), depersonalization (MBI-DP) (5 items) and personal accomplishment (MBI-PA) (7 items). Items are answered on a 6-point Likert scale between '1' = never and '6' = very often. In our study, we only used the emotional exhaustion (EE) scale. EE refers to feelings of overextension in work, which we hypothesized to be affected by the pandemic. The dimension 'emotional exhaustion' is considered the core dimension of burnout and its most obvious manifestation (Maslach et al., 2001). The internal consistency of the subscale EE with Cronbach's alpha is $\alpha = 0.89$. The convergent and discriminant validity are indicated as acceptable (Maslach & Jackson, 1981). The German version MBI-D used has acceptable validity. Internal consistency was determined for the subscale EE with Cronbach's alpha $\alpha = 0.89$ (Büssing & Perrar, 1992).

2.4. Data analysis

All statistical analyses were performed with SPSS version 21. Only valid cases were included and reported for each analysis.

The associations between the number of ACEs, COVID-19 related problems and the EE scale of the MBI were assessed with Pearson's correlation analyses. Linear regression analyses were performed in order to assess the relevance of different single subtypes of ACEs for EE in healthcare professionals.

Mediation analyses were performed with the macro PROCESS by Hayes (2017) for SPSS. Ordinary least squares path analyses were conducted using 5,000 bootstrapping samples. The number of experienced subtypes of ACEs served as independent variable and EE as dependent variable. COVID-19-associated problems served as mediator variable, sex as covariate (diverse participants were excluded). The total effect represents the association between the number of experienced ACEs and EE without inclusion of the mediator, the direct effect represents the association between ACEs and EE after inclusion of the mediator and the indirect effect represents the part of the association between ACEs and EE that is mediated. Mediation analysis was only performed if correlation analysis pointed towards a significant association between the respective COVID-19 associated item and ACEs. *P*-values below 0.5 were considered as statistically significant.

3. Results

3.1. Sample

A total of 2500 participants completed the survey of which 563 (22.5%) were male and 1930 (77.2%) were female. Seven participants stated to be diverse (0.3%). Most of the participants were between 18 and 60 years old ($n = 2315$, 92.6%), and 185 participants (7.4%) were older than the age of 60. Most participants were working as medical-technical assistant (52.1%, $n = 1265$), followed by physicians (24.9%, $n = 606$), nurses (8.0%, $n = 195$), paramedics (5.0%, $n = 121$) and other professions (10.0%, $n = 242$) (Table 1).

3.2. Prevalence of ACEs and EE

The majority of participants stated to have experienced no ACEs ($n = 819$, 39.9%) or 1–3 ACEs during childhood ($n = 981$, 47.8%). Only 252 (12.3%) reported to have experienced 4 ACEs or more. The EE score of the MBI ranged between 3 and 18. The mean score of all participants was 11.3 ± 3.9 (Table 1).

3.3. Correlations between ACEs, COVID-19-associated problems and emotional exhaustion

The ACE score correlated significantly positive with the EE score. Furthermore, correlation analyses revealed a significant association between ACE score and COVID-19 associated problems. In detail, a positive correlation was seen between ACE Score and the items '... I felt that patient safety was suffering because of the workload', "... I smoked more", "... I drank more alcohol", "... I took more

Table 1. Sample characteristics. Presented as mean (M) \pm standard deviation (SD) or number of participants (% = valid percentage).

	N (%)
Gender	
Male	563 (22.5)
Female	1930 (77.2)
Diverse	7 (0.3)
Age group	
18–30	524 (21.0)
31–40	541 (21.6)
41–50	552 (22.1)
51–60	698 (27.9)
61–70	167 (6.7)
>70	18 (0.7)
Profession	
Physician	606 (24.9)
Nursing staff	195 (8.0)
Medical-technical assistant	1265 (52.1)
Paramedics	121 (5.0)
Other	242 (10.0)
Number of experienced ACEs	
0	819 (39.9)
1–3	981 (47.8)
≥ 4	252 (12.3)
Emotional exhaustion	
Mean (SE)	11.3 (± 3.9)

antidepressants/tranquilizers“, “... I suffered from sleep problems.“, “... I felt physically or mentally exhausted“ and “... I was afraid of having to decide who would receive care and who would not“. The ACE score correlated negatively with the items “... I felt protected by the measures taken by national and local authorities“, and “... I felt protected as an employee by measures taken by my employer“. Those items correlated as well negatively with the emotional exhaustion. The correlation analysis revealed a significant positive correlation between emotional exhaustion and the items “... I felt physically or mentally exhausted“, “... I was burdened by the increase in my workload.“, “... I felt burdened by the change in my tasks.“, “... I didn’t wanted to work“, “... I suffered from sleep problems.“, “... I felt that patient safety was suffering because of the workload“, and on a low level with the Items “... I was afraid of infecting myself“, “... I was afraid of infecting relatives or family.“, “... I was afraid of having to decide who would receive care and who would not“, “... I smoked more“, “... I drank more alcohol“, “... I took more antidepressants/ tranquilizers“, and “... I was burdened by the idea that my patients could die without seeing their relatives again“ (see Table 2 for r values and significance levels).

3.4. ACEs predict EE in healthcare professionals

Regression analyses of ACEs and EE revealed that all subtypes of child maltreatment were associated with EE. Furthermore, significant predictors of higher EE score were loss of a parent, substance misuse of a household member and mental illness of a household member (Table 3). Total effect of mediation analysis revealed that an increasing number of experienced ACEs significantly predicted higher scores on the EE scale ($B = 0.3334$, $F = 32.02$, $R^2 = 0.03$, $p < .001$).

The association between ACEs and EE was mediated significantly by all assessed COVID-19 related problems. Strongest mediation was seen for the items ‘sleep problems’ and ‘physical or mental exhaustion’ (Table 4).

4. Discussion

To the best of our knowledge, this is the first study assessing the role of COVID-19 associated burden in the interplay between ACEs and EE in healthcare professionals. Our results show significantly increased COVID-19 associated burden in dependence of a higher number of experienced ACE forms. Several singular ACEs were associated with EE in a dose-dependent manner. This relation was partially mediated by COVID-19 related burden.

The prevalence of ≥ 4 ACEs in German healthcare professionals was comparable to the prevalence in the general population (10.1% vs. 8.9%), while the percentage of subjects having experienced at least one type of ACEs was higher in our population of healthcare professionals (49.3% vs. 43.7%) (Witt, Sachser, Plener, Brähler, & Fegert, 2019). One reason for this finding may be that in our sample, the majority of participants were female. Females are at higher risk for some ACEs, particularly sexual abuse (Witt et al., 2018). However, the prevalence rates of ACEs in our sample are comparable to those of a sample of US physicians (Yellowlees et al., 2021). In sum, our data suggest that healthcare professionals in Germany have at least similar, if not higher rates of ACEs compared to the general population. This suggests that ACEs may be a significant risk factor for psychosocial problems as well as mental and somatic health problems (Clemens et al., 2018; Felitti et al., 1998; Norman et al., 2012; Rehkopf et al., 2016) also in healthcare professionals – just as in the general population.

In our study, we focused on EE as a long-term risk of experienced ACEs. Consistent with previous studies reporting an increased risk for health problems depending on the number of experienced ACEs (Clemens et al., 2018; Felitti et al., 1998), our findings confirm that more ACEs are associated with an increased risk for EE in healthcare professionals. Our results are in line with a recent study finding that the more ACEs a physician has experienced, the higher is the odds of experiencing burnout many years later (Yellowlees et al., 2021). To the best of our knowledge, there is no other study assessing the relation between ACEs and burnout in such a broad sample of different healthcare professions. Given the important implications of burnout among healthcare professionals, including increased risks for medical errors and suicidal thoughts (Brown et al., 2009; Montgomery et al., 2021; Patel et al., 2018; van der Heijden et al., 2008), there is a need for targeted support. Particularly, as the risk for burnout is generally high in healthcare professions (Martini et al., 2004). A significant, but limited proportion of EE was predicted by ACEs and the assessed COVID-19 related burden. Other already well-known risk factors for burnout in the medical field comprise, e.g. working at the emergency department, younger age, female gender, a challenging work environment, a bad work life balance and financial worries (Kansoun et al., 2019; Zhou et al., 2020). The results of our study suggest that the experience of ACEs should be considered as an additional significant predictor for EE in healthcare professionals.

In our sample, an increasing number of ACEs was associated with more burden due to the COVID-19 pandemic. The association between ACEs and EE was partially mediated by this burden. This finding indicates that the pandemic accelerates the already

Table 2. Correlations between ACE score, COVID-19 associated problems and EE (r values reported).

	...I was afraid of infecting myself.	...I was afraid of infecting relatives or family.	...I was burdened by the increase in my workload.	...I felt protected by the measures taken by national and local authorities.	...I felt protected as an employee by measures taken by my employer.	...I suffered from sleep problems.	...I felt physically or mentally exhausted.	...I was afraid of having to decide who would receive care and who would not.	...I was burdened by the idea that my patients could die without seeing their relatives again.	...I felt that patient safety was suffering because of the workload.	...I smoked more.	...I drank more alcohol.	...I took more antidepressants/ tranquilizers.	Emotional exhaustion ACE score
...I was afraid of infecting myself.	1	0.606***	0.245***	-0.091***	-0.232***	0.524***	0.229***	0.273***	0.205***	0.254***	0.050*	0.083***	0.120***	0.283***
...I was afraid of infecting relatives or family.		1	0.256***	-0.086***	-0.183***	0.374***	0.210***	0.266***	0.276***	0.285***	0.072***	0.070**	0.078***	0.264***
...I was burdened by the increase in my workload.			1	-0.136***	-0.169***	0.258***	0.275***	0.470***	0.180***	0.423***	0.098***	0.069**	0.115***	0.516***
...I felt burdened by the change in my tasks.				-0.181***	-0.111***	0.280***	0.294***	0.376***	0.164***	0.255***	0.072***	0.115***	0.119***	0.348***
...I felt protected by the measures taken by national and local authorities.				1	0.389***	-0.163***	-0.166***	-0.172***	-0.125***	-0.188***	-0.108***	-0.071**	-0.088***	-0.189***
...I felt protected as an employee by measures taken by my employer.					1	-0.302***	-0.163***	-0.196***	-0.094***	-0.279***	-0.051*	-0.063**	-0.061**	-0.284***
...I didn't want to work.						1	0.274***	0.301***	0.156***	0.292***	0.090***	0.126***	0.181***	0.348***
...I suffered from sleep problems.							1	0.623***	0.173***	0.230***	0.109***	0.178***	0.251***	0.456***
...I felt physically or mentally exhausted.								1	0.163***	0.309***	0.078***	0.143***	0.189***	0.615***
...I was afraid of having to decide who would receive care and who would not.								1	0.311***	0.334***	0.077***	0.122***	0.112***	0.226***
...I was burdened by the idea that my patients could die without seeing their relatives again.									1	0.330***	0.100***	0.122***	0.096***	0.174***
...I felt that patient safety was suffering because of the workload.										1	0.118***	0.096***	0.110***	0.376***
...I smoked more.											1	0.278***	0.122***	0.108***

(Continued)

Table 2. (Continued).

... I drank more alcohol.	... I was denied by the increase in my workload	... I felt protected by the measures taken by national and local authorities.	... I felt protected as an employee by measures taken by my employer.	... I suffered from sleep problems.	... I felt physically or mentally exhausted.	... I was afraid of having to decide who would receive care and who would not.	... I was burdened by the idea that my patients could die without seeing their relatives again.	... I felt that patient safety was suffering because of the workload.	... I drank more alcohol.	... I took more antidepressants/ tranquilizers.	Emotional exhaustion ACE score
									1	0.190***	0.148***
										1	0.191***
											1
											0.144***
											1

Note: $N = 2052-2349$; *** $p < 0.001$, ** $p < .01$, * $p < .05$.

Table 3. Results of regression analyses with subtypes of ACEs predicting EE.

	Unstandardized B	95%CI	R ²	p-Value
Emotional Abuse	1.101	(0.691; 1.511)	0.023	<0.001
Physical Abuse	0.656	(0.131; 1.182)	0.013	0.014
Sexual Abuse	0.854	(0.294; 1.414)	0.014	0.003
Emotional Neglect	1.476	(1.081; 1.872)	0.034	<0.001
Physical Neglect	1.066	(0.109; 2.023)	0.012	0.029
Loss of a parent (due separation or other reason)	0.407	(0.005; .810)	0.012	0.047
Violence against the mother	0.472	(−0.213; 1.156)	0.011	0.177
Substance misuse within household	0.674	(0.261; 1.086)	0.015	0.001
Household mental illness	0.674	(0.300; 1.048)	0.016	<0.001
Incarceration of a household member	0.754	(−0.390; 1.899)	0.011	0.196

Assessed via regression analyses, controlled for gender. 95%CI = 95% Confidence Interval. R² = Nagelkerkes R². N = 2099–2125.

increased risk for EE in healthcare professionals with ACEs. An increased burden due to the pandemic and consequently more mental health problems were shown for healthcare professionals – not only for those with ACEs (Gross, Mohren, & Erren, 2021). However, the experience of ACEs is associated with heightened neural response to threat (Hein & Monk, 2017), increased emotional reactivity, blunted reward responsivity and poorer emotion regulation (Duffy et al., 2018). These factors may lead to an increased vulnerability for pandemic-associated stressors. Not surprisingly, ACEs were already found to be associated with higher distress during the pandemic: In the general population, higher rates of loneliness (Shreffler et al., 2021) and higher depressive symptoms during the pandemic were seen for persons with ACEs (Kim, Nyengerai, & Mendenhall, 2020; Prout et al., 2020). Additionally, healthcare professionals of our sample showed that ACEs as well as EE are associated with maladaptive coping strategies such as alcohol drinking, drug and medication use. An increased risk for alcohol and drug abuse is known for persons who have experienced ACEs (Felitti et al., 1998).

One major limitation of our study is that the participants cannot be considered as representative for all healthcare professionals, as a non-probability sample based on participation in an online survey was used. Particularly, the majority of participants were female. An overrepresentation of healthcare professionals who felt particularly burdened by the pandemic cannot be excluded, as the assessment of ACEs and EE was not highlighted in the informed consent form but overall assessments of COVID-19 related burdens in healthcare professionals were named as the main aim of the study. Therefore, the

Table 4. Association between ACEs, COVID-19 associated problems and EE, assessed via mediation analysis.

	Total effect ¹	Direct effect ²	Indirect effect (mediation) ³	F	R ²
...I was burdened by the increase in my workload.	0.3334*	0.2651	0.0683*	266.24	0.2809
...I felt burdened by the change in my tasks.	0.3334*	0.2954*	0.0380*	115.00	0.1444
...I felt protected by the measures taken by national and local authorities.	0.3334*	0.3034*	0.0300*	48.20	0.0660
...I felt protected as an employee by measures taken by my employer.	0.3334*	0.2803*	0.0531*	80.30	0.1054
...I didn't wanted to work.	0.3334*	0.2935*	0.0398*	113.33	0.1426
...I suffered from sleep problems.	0.3334*	0.1708*	0.1626*	193.66	0.2212
...I felt physically or mentally exhausted.	0.3334*	0.1525*	0.1809*	432.94	0.3884
...I was afraid of having to decide who would receive care and who would not.	0.3334*	0.2871*	0.0463*	56.96	0.0771
...I was burdened by the idea that my patients could die without seeing their relatives again.	0.3334*	0.3172*	0.0162*	40.18	0.0557
...I felt that patient safety was suffering because of the workload.	0.3334*	0.2772*	0.0561*	133.22	0.1635
...I smoked more.	0.3334*	0.3035*	0.0299*	27.52	0.0388
...I drank more alcohol.	0.3334*	0.3005*	0.0329*	35.92	0.0501
...I took more antidepressants/ tranquilizers.	0.3334*	0.2757*	0.0577*	41.07	0.0568

¹Total effect refers to the association between ACEs and EE without inclusion of COVID-19 associated problems. ²Direct effect refers to the association between ACEs and EE after inclusion of a single COVID-19 associated problem. ³Indirect effect refers to the part of the association between ACEs and EE that is mediated by COVID-19 associated problems. Analyses were adjusted for sex. Presented as B (unstandardized coefficient). R² = Nagelkerkes R². N = 2049. F and R² are given for the total model, including ACEs and COVID-19 associated problems. * p value < 0.05.

generalizability of our results is limited. ACEs were assessed retrospectively by self-report. The use of retrospectively assessed ACEs is on debate (Baldwin, Reuben, Newbury, & Danese, 2019); however, the relevance of subjective adversity for health was underlined recently (Danese & Widom, 2020). In order to guarantee the anonymous character of our survey, age was only assessed using age groups. Therefore, controlling for age as a covariate was not possible, which may bias the results. To ensure brevity and consequently higher completion rates of the survey, only the subscale EE of the MBI was used. As our survey had a cross-sectional character, causality cannot be deduced. However, further surveys with

this sample are planned to enable longitudinal analyses. One item on COVID-19 associated problems recorded physical and mental exhaustion. This item is somewhat similar to the concept of the dimension of EE of the MBI. It cannot be ruled out that study participants did not distinguish between 'physical and mental' exhaustion on the one hand and emotional exhaustion on the other.

5. Conclusion

The presented results give a meaningful first insight into the relevance of ACEs and COVID-19 associated burden and their effects on EE in healthcare professionals. Taken together, our findings suggest ACEs as a significant risk factor for EE. The current pandemic leads to increased psychological distress (Di Nicola et al., 2020) and means a significant burden that further escalates the risk for EE. Knowledge on this increased risk in healthcare professionals who have experienced adversity during childhood can contribute to a better understanding of oneself, a greater awareness regarding possible warning signals for EE and thus, in the long term, prevention of EE. Factors such as self-care and emotion regulation, which are known to mediate the negative psychological effects of ACEs (Janiri et al., 2021; La Mott & Martin, 2019) should be strengthened by targeted programmes for healthcare providers – particularly during these pandemic times. Programmes may comprise support such as coaching on the individual and team level and Balint groups. Research on the development and evaluation of targeted support programmes for healthcare professionals with individual risk factors such as ACEs, in particularly stressful times such as a pandemic is needed.

Disclosure statement

VC, PB, MJ, KW, MK, EM, FG, CA, SSS, HG and LJB declare that there is no conflict of interest.

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Data availability statement

The dataset generated and analyzed during the current study is not publicly available due to confidentiality agreements made with participants but is available from the corresponding author on reasonable request.

Ethics approval

The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. After consultation with the ethics committee of the University of Ulm, there was no requirement for an ethics vote.

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