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Identifying subgroups of adverse childhood experiences (ACEs) in adult general hospital attendees: associations with mental and physical health measures

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ABSTRACT

Background: Adverse childhood experiences (ACEs) are linked to negative mental and physical health outcomes. While increased ACE exposure often correlates with worse health outcomes, specific combinations of ACEs may heighten the risk for certain conditions and diseases.

Method: Participants (n = 2642) attending inpatient and outpatient departments at an Austrian university hospital provided self-reported measures of physical and mental health, along with retrospective assessments of ACEs. Latent class analysis was utilized to identify subgroups of individuals with co-occurring ACEs. Logistic regression models were employed to investigate the associations between ACE clusters and the prevalence of physical and mental health conditions.

Results: Six classes were identified, with the majority of individuals falling into the 'minimal ACEs' class. However, other groups reported specific ACEs such as 'peer-bullying', 'home-neglect', and 'physical abuse', while two groups experienced a variety of ACEs ('parent abuse and neglect' and 'parental and peer bullying'). Classes were differentially associated with the likelihood of reporting specific mental and physical conditions, with higher odds ratios observed in groups endorsing higher ACEs.

Conclusions: This exploratory analysis found that different ACE constellations were associated with varying risks of specific mental and physical health conditions. Identifying individuals within particular ACE clusters could help inform preventive strategies and improve adult health outcomes.

1. Introduction

Adverse Childhood Experiences (ACEs) are established contributors to an array of negative health outcomes in later life, including mental illness, substance use, sexual risk-taking behaviour, interpersonal and self-directed violence, and non-communicable diseases (Hughes et al., 2017). As direct or indirect harm to a child within their living environments, ACEs encompass a range of adversities from witnessing abusive behaviour to experiencing neglect or abuse. The global prevalence of ACEs is alarmingly high, with an estimated 1–38% of individuals reporting exposure to at least four ACEs, and only 12–67% of individuals claiming no exposure to ACEs (Hughes et al., 2017). The interrelated nature of ACEs suggests that experiencing one form of adversity typically increases the likelihood of encountering another, and greater adversity is associated with increasingly worse health outcomes (Barboza, 2018). Research into ACEs has largely adopted a cumulative

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risk approach, through examining the association between multiple co-occurring ACEs and specific health outcomes. However, this approach can neglect the individual impacts and specific co-occurrences of ACEs. In particular, it fails to discern whether different ACEs differentially associate with specific health outcomes, whether specific ACEs have an additive effect, and under what contexts ACEs may lead to poorer health outcomes (Barboza, 2018).

Recent interest in ACEs has led to the exploration of co-occurrence patterns within individuals and their associations with health outcomes across the lifespan. Latent mixture models, such as latent class analysis (LCA), offer data-driven methods to identify distinct groups or profiles based on their ACEs (Masyn, 2013; Saunders et al., 2020). By identifying individuals who have experienced specific constellations of ACEs, these approaches can help address the limitations of cumulative risk models and offer a more nuanced understanding of the impacts of ACEs on health outcomes. LCA has been utilized in previous studies to discern sub-groups of ACEs presentations within the general population. Specifically, three separate studies in Germany, the Netherlands and the United Kingdom each identified four classes (Bussemakers et al., 2019; Lacey et al., 2020; Witt et al., 2019). Three studies all discovered a group with a low prevalence of ACEs, a group with a high prevalence of ACEs, a group moderately exposed to dysfunctional households, and a group moderately exposed to child maltreatment. Additional studies focusing on specific populations have found greater variation in the number of identified classes; four classes of ACEs were found amongst college students (Merians et al., 2019), whereas five classes were identified in adolescents within the justice system (Wolff et al., 2018), and five classes were identified in UK male military veterans (Ross et al., 2022). The observed differences across these studies could potentially reflect the varying prevalence of ACEs in different populations and how their measurement is operationalized. Furthermore, previous studies have seldom examined peer-related emotional and physical abuse, despite evidence for the negative long-term impacts of bullying (Wolke and Lereya, 2015). Determining the co-occurrence of ACEs and understanding how these sub-groups are associated with different health outcomes could facilitate the identification of at-risk individuals and promote the use of preventative medicine.

General hospital attendees are an important population in which to examine the relationship between physical health conditions and psychosocial trauma. For many of these patients, psychological history is often overlooked and focus is given to an individual's physical condition (Morgan and Killoughery, 2003), despite those with physical health conditions having a substantially high prevalence of mental disorders (Barnett et al., 2012; Roy-Byrne et al., 2008). It has also been shown that physical conditions and ACEs can co-occur in one recent study looking at individuals in a cohort over a 14-year time period (Parnes and Schwartz, 2022), although the population under consideration were not general hospital attendees. For individuals with co-occurring physical and mental disorders, prognoses are worse (Callahan, 2001) and healthcare costs are estimated to be around 50 % higher than those who only have a physical condition (Naylor et al., 2012). As such, understanding how ACEs and physical health conditions co-occur for general hospital attendees has significant clinical and economic importance.

Earlier analysis has demonstrated an association between the number of ACEs experienced and the subsequent likelihood of mental health difficulties and prevalence of physical health disorders. An analysis of data from general hospital attendees found that individuals reporting between one and three childhood ACEs (out of a maximum of seven ACE categories) were at an increased risk of several health conditions (Riedl et al., 2020). These include gastrointestinal, musculoskeletal, gynecological, respiratory, urogenital, and neurological disorders, as well as heightened current psychological distress, compared to participants reporting zero ACEs. Participants reporting four or more ACEs were at an increased risk of the same disorders, with additional risk of metabolic, skin, and cardiovascular disorders, and significantly increased ongoing psychological distress. This data could be further utilized to comprehend the impact of ACEs, as the original analysis did not examine whether the constellations of different ACEs were associated with a differential likelihood of mental and physical health issues. Such insights could afford a more nuanced understanding of the relationship between ACEs and later-life health status.

The present cross-sectional study aimed to 1) identify sub-groups of general hospital attendees in relation to the ACEs they experienced and 2) ascertain whether these sub-groups were associated with an increased risk of mental and physical health conditions.

2. Method

2.1. Sample and procedure

The study population comprised general hospital attendees at the University Hospital of Innsbruck, Austria. Potential participants were approached in the waiting areas of seven departments: otolaryngology, trauma surgery, neurosurgery, neurology, gynaecology, internal medicine, and radiology, although they could self-report a variety of conditions. Data collection took place from October 2015 to March 2017. Whenever possible, participants completed questionnaires privately and anonymously, using paper and pencil, in a separate section of the waiting area. All participants were provided with an address for accessing free professional psychological support. Research assistants were on hand while participants completed the measures to ensure privacy and answer questions. The study received ethical approval from the Medical University of Innsbruck ethics committee (AN2015-0175 351/4.18), and the dataset has been presented in previous studies (Riedl et al., 2019, 2020).

2.2. Measures

2.2.1. Adverse childhood experiences (ACEs)

ACEs were measured using the German-version of the Maltreatment and Abuse Chronology of Exposure Scale (MACE) (Isele et al., 2014). The MACE consists of 75 items that assess the severity of past maltreatment exposure. Participants indicated whether each type of maltreatment occurred every year until they reached the age of 18. The 75 items were grouped into 10 ACE categories for the current analysis: parental verbal abuse, parental non-verbal abuse, parental physical abuse, emotional neglect, physical neglect, witnessing parental violence, witnessing violence to siblings, peer verbal abuse, peer physical abuse, and sexual abuse. Appendix A presents the individual subscales, the number of items in each subscale, and the threshold used to consider the presence of an ACE on each individual subscale. The MACE total score has strong internal consistency ($\alpha = 0.92$) and excellent overall reliability.

2.2.2. Internalising symptoms

The German version of the Brief Symptom Inventory – 18 items (BSI-18) (Franke et al., 2017) was used to measure symptoms of internalising problems. The BSI-18, derived from the 53-item BSI (Derogatis, 1975), includes only the depression, anxiety, and somatisation subscales. The BSI-18 subscales have good internal consistency (the global severity index $\alpha = 0.93$, depression $\alpha = 0.87$, anxiety $\alpha = 0.84$ and somatisation $\alpha = 0.82$).

2.2.3. Traumatic events and symptoms

The Essen Trauma-Inventory (ETI) (Tagay and Senf, 2014), is a self-rated questionnaire, that assesses potential traumatic events alongside DSM-IV-TR post-traumatic stress symptoms. The ETI comprises four subscales: intrusion, avoidance, hyperarousal, and dissociation, with the total score calculated by summing all items across the four subscales. The ETI has demonstrated excellent reliability ($\alpha = 0.95$) in previous studies (Tagay et al., 2014), as well as in the current dataset ($\alpha = 0.95$).

2.2.4. Self-reported health conditions

The prevalence of disorders and conditions were self-reported by participants using a comprehensive checklist, derived from the German Pain Questionnaire (Association GP, 2015). Participants could rate both the presence and the associated level of impairment of each condition. For the current analysis, conditions were grouped as follows: cancer, neurological disorders, respiratory disorders, cardiovascular disorders, gastrointestinal disorders, liver disorders, urogenital disorders, metabolic disorders, skin disorders, musculoskeletal disorders, gynaecological disorders, allergies, chronic pain, and psychological disorders.

2.2.5. Demographic variables

In addition to the measures under consideration, a range of demographic data was collected from each participant. If not missing, this included: age, gender (male, female), relationship status (single, married/partner, separated/divorced, widowed), living situation (living alone, living with partner/family, living with family of origin, living in shared apartment, living in an institution), education level (not finished school, compulsory school, school and apprentice, higher education, university degree).

2.2.6. Data analysis

Latent class analysis was employed to identify statistically distinct subgroups of individuals based on whether they had experienced one of the 10 ACEs, as measured by the MACE. For the present analysis, the presence of each ACE was treated as a binary indicator, either endorsed (experienced) or not. The cut-off values for each ACE were obtained from the MACE (Isele et al., 2014) and have been used in previous studies employing this measure (Riedl et al., 2020). Appendix A provides the ACE subscales and cut-offs.

LCA offers several model fit statistics to help determine the number of classes to accept. Previous studies evaluating optimum class solutions have recommended the adjusted-Bayesian information criterion (BIC) and the Bootstrapped likelihood-ratio-test (BLRT) due to their superior performance over other model fit statistics. Thus, these two statistics were used to decide on an appropriate class solution (Nylund et al., 2007). Lower BIC scores suggest better data fit, whereas a significant BLRT p-value ($p < 0.05$) indicates that the K model fits the data better than the K-1 model (model with one fewer class). The entropy value was also included as a measure of classification accuracy, showing how confidently the model could determine the class each individual was most likely to belong to. Given there was no prior hypothesis regarding the number of classes to be identified, the analysis began with the 2-class model, and the number of classes increased until the model fit statistics indicated no improvement (Saunders et al., 2016).

Once the best fitting class solution was identified, exploratory logistic regression models were constructed to investigate whether class membership was associated with an increased likelihood of current mental health difficulties, as well as the prevalence of physical health conditions. Models were constructed with age and gender included as potential confounders. In the initial analyses, the class with minimal ACEs was used as the reference category, with the odds of each health condition presented for each class compared to the class with minimal ACEs. Adjusted odds ratios with 95 % confidence intervals (95%CIs) are presented, with alpha set at <0.05. Further analyses were conducted using an alternative reference category to distinguish individuals reporting emotional neglect and verbal abuse within their home from individuals who: received physical abuse at home and witnessed violence, received and witnessed verbal, emotional and physical abuse in the home, experienced emotional abuse in their external environment, and experienced emotional and physical abuse from peers as well as verbal abuse at home. Latent class analysis was carried out in Mplus Version 8 (Muthén and Muthén, 2015), while all other analysis was conducted in stata 16 (Stata Press, 2019). Missing data on ACEs for the latent class analysis was handled with Full Information Maximum-Likelihood using Mplus' Expectation Maximisation (EM) algorithm (Dempster et al., 1977).

3. Results

3.1. Descriptive statistics

In the current study, a total of 2642 individuals who provided data on ACEs were included. The descriptive statistics for this sample are presented in Table 1. We observed the 30–49 years of age was the most frequent age category reported (34 %), and were most likely to be female (52 %), married or with a partner (64 %). The average number of physical health conditions reported was 1.5 per person, or which chronic pain was the most common (reported by 32 % of respondents). Of the full sample, 18 % reported BSI scores above the clinical cut-off, and 15 % reported scores above the ETI cut-off.

3.2. Latent class analysis

Initial LCA was performed using the 10 ACE indicators available, with model fit statistics provided in Appendix B. The sample-size adjusted BIC continued to decrease until the 6-class solution, suggesting that the 5-class solution was most preferable. However, the BLRT p-values remained statistically significant ($p < 0.05$) until the 7-class solution ($p = 0.200$), indicating that the 6-class solution was preferable. Given support for both class solutions, the identified classes in the 5- and 6-class models were compared. As displayed in Appendix C, Classes 1–5 in both solutions appeared very similar, but the sixth identified class was distinct, showing a very high likelihood of endorsing multiple ACEs. Despite the 6-class solution constituting a small proportion of the sample, it was retained due to the potential clinical value of this group of individuals given the more extreme number of ACE's experienced.

The 6-class model is displayed in Fig. 1, with descriptive statistics provided alongside those of the full sample in Table 1. The six classes can be described as follows:

Class 1: Minimal ACEs

This was the largest class in the sample (78% of all included cases), reporting minimal ACEs.

Class 2: Bullied emotionally

This class was likely to report emotional abuse from peers but unlikely to report any other ACEs. Comprising 7% of the sample, these individuals were typically younger and a large proportion had higher or university-level education.

Class 3: Difficult homes

This class reported a reasonably high likelihood of parental verbal and/or physical abuse, as well as having witnessed violence against their siblings. They were very unlikely to report neglect or abuse from peers.

Class 4: Emotional neglect

This class was likely to report emotional neglect alongside parental verbal/non-verbal abuse. Two-thirds of this class were female, with BSI scores similar to Classes 2 and 3, but ETI scores similar to Classes 5 and 6, suggesting potentially more traumatic experiences.

Class 5: Parental and peer bullying

This class reported a very high likelihood of experiencing parental verbal abuse and peer emotional and physical abuse. The likelihood of parental physical abuse, witnessing violence against siblings, and sexual abuse was also comparatively high. This group constituted less than 2%

Table 1
Descriptive statistics of full sample and individual classes.

		Full Sample n = 2642	Class 1 n = 2057 (77.9 %)	Class 2 n = 187 (7.1 %)	Class 3 n = 195 (7.4 %)	Class 4 n = 121 (4.6 %)	Class 5 n = 48 (1.8 %)	Class 6 n = 34 (1.3 %)	Group Comparison (Chi Square or ANOVA)
		n (%) or m (sd)	*n (%) or m (sd)*	*n (%) or m (sd)*	*n (%) or m (sd)*	*n (%) or m (sd)*	*n (%) or m (sd)*	*n (%) or m (sd)*	
Age	18–29	653 (25)	461 (22)	85 (45)	42 (22)	37 (31)	21 (44)	7 (21)	X^2 (15,N = 2442) = 82.29, $p < 0.001$
	30–49	895 (34)	696 (34)	66 (35)	66 (34)	37 (31)	19 (40)	11 (32)	
	50–69	722 (27)	583 (28)	21 (11)	62 (32)	38 (31)	4 (8)	14 (41)	
	70+	172 (7)	148 (7)	4 (2)	10 (5)	7 (6)	2 (4)	1 (3)	
	missing	200 (8)	169 (8)	11 (6)	15 (8)	2 (2)	2 (4)	1 (3)	
Gender	Male	1155 (44)	944 (46)	71 (38)	77 (39)	33 (27)	20 (42)	10 (29)	X^2 (5,N = 2521) = 27.67, $p < 0.001$
	Female	1366 (52)	1010 (49)	109 (58)	114 (58)	83 (69)	27 (56)	23 (68)	
	Missing	121 (5)	103 (5)	7 (4)	4 (2)	5 (4)	1 (2)	1 (3)	
Relationship Status	single	609 (23)	437 (21)	68 (36)	41 (21)	33 (27)	22 (46)	8 (24)	X^2 (15,N = 2492) = 66.99, $p < 0.001$
	married/partner	1678 (64)	1349 (66)	99 (53)	120 (62)	64 (53)	21 (44)	25 (74)	
	separated/divorced	172 (7)	118 (6)	9 (5)	24 (12)	17 (14)	3 (6)	1 (3)	
	widowed	33 (1)	29 (1)	0 (0)	2 (1)	2 (2)	0 (0)	0 (0)	
	missing	150 (6)	124 (6)	11 (6)	8 (4)	5 (4)	2 (4)	0 (0)	
Living Situation	living alone	501 (19)	358 (17)	42 (22)	43 (22)	33 (27)	17 (35)	8 (24)	X^2 (20,N = 2373) = 80.38, $p < 0.001$
	living with partner/ family	1500 (57)	1213 (59)	86 (46)	105 (54)	60 (50)	15 (31)	21 (62)	
	living with family of origin	179 (7)	143 (7)	17 (9)	8 (4)	7 (6)	2 (4)	2 (6)	
	living in shared apartment	192 (7)	131 (6)	27 (14)	13 (7)	12 (10)	9 (19)	0 (0)	
	living in an institution	1 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	
	missing	269 (10)	212 (10)	15 (8)	26 (13)	8 (7)	5 (10)	3 (9)	
Education Level	not finished school	45 (2)	25 (1)	7 (4)	5 (3)	2 (2)	5 (10)	1 (3)	X^2 (20,N = 2363) = 59.08, $p < 0.001$
	compulsory school	207 (8)	161 (8)	10 (5)	13 (7)	11 (9)	7 (15)	5 (15)	
	school and apprentice	919 (35)	732 (36)	46 (25)	79 (41)	37 (31)	13 (27)	12 (35)	
	higher education	725 (27)	562 (27)	60 (32)	44 (23)	34 (28)	15 (31)	10 (29)	
	university degree	467 (18)	345 (17)	52 (28)	34 (17)	25 (21)	6 (13)	5 (15)	
	missing	279 (11)	232 (11)	12 (6)	20 (10)	12 (10)	2 (4)	1 (3)	
Essen Trauma Inventory	Total score	10.59 (12.57)	8.3 (10.4)	12.5 (13)	14.7 (13.6)	22.4 (16)	26.6 (17.4)	28.7 (16.5)	**F(1, 1902)** = 342.8 ($p < 0.001$)
	Intrusion	2.93 (3.41)	2.4 (3)	3.4 (3.5)	4.1 (3.9)	5.9 (4.2)	6.3 (4.4)	6.9 (4.2)	**F(1, 1905)** = 246.6 ($p < 0.001$)
	Avoidance	3.31 (4.28)	2.5 (3.5)	4 (4.5)	4.6 (4.6)	7.5 (5.7)	8.9 (5.9)	9.5 (5.7)	**F(1, 1904)** = 357.4 ($p < 0.001$)
	Hyper arousal	2.54 (3.00)	2 (2.6)	2.9 (2.9)	3.7 (3.3)	5 (3.7)	6.1 (4.2)	6.5 (3.6)	**F(1, 1904)** = 286.5 ($p < 0.001$)
	Dissociation	1.82 (2.97)	1.4 (2.4)	2.2 (3.4)	2.3 (2.9)	4.2 (4.1)	5.2 (4.7)	5.9 (4.6)	**F(1, 1904)** = 239.6 ($p < 0.001$)
Brief Symptom Inventory - 18	Total score	7.27 (8.85)	6 (7.6)	10.5 (10.3)	11.3 (11.6)	11 (10.8)	16.8 (11.7)	16.5 (12.6)	**F(1, 2550)** = 212.9 ($p < 0.001$)
	Depression	1.96 (3.49)	1.4 (2.8)	3.1 (4.1)	3.9 (5)	3.2 (4.3)	6.2 (5.7)	5.3 (6)	**F(1, 2550)** = 224 ($p < 0.001$)
	Anxiety	2.57 (3.51)	2.1 (3.1)	3.6 (4)	3.9 (4.3)	4.2 (4.3)	6.4 (4.6)	5.7 (4.6)	**F(1, 2550)** = 188.1 ($p < 0.001$)
	Somatisation	2.74 (3.32)	2.4 (3.1)	3.7 (3.8)	3.5 (3.8)	3.6 (3.7)	4.2 (3.5)	5.4 (4.3)	**F(1, 2550)** = 70.22 ($p < 0.001$)
	Average n of physical conditions present	1.5 (1.7)	1.4 (1.6)	1.7 (1.5)	2.0 (1.9)	1.8 (1.6)	2.2 (2.2)	3.2 (2.2)	X^2 (50,N = 2642) = 177.8, $p < 0.001$
	Cancer	353 (14)	283 (14)	11 (6)	30 (16)	19 (16)	5 (11)	5 (15)	X^2 (5,N = 2577) = 11.15, $p < 0.05$
	Neurological disorder (s)	398 (15)	296 (15)	31 (17)	31 (16)	24 (21)	6 (13)	10 (29)	X^2 (5,N = 2577) = 8.68, $p = 0.122$
	Respiratory disorder(s)	407 (16)	296 (15)	34 (19)	33 (17)	20 (17)	15 (32)	9 (26)	X^2 (5,N = 2577) = 15.17, $p < 0.05$

(*continued on next page*)

Table 1 (*continued*)

	Full Sample n = 2642	Class 1 n = 2057 (77.9 %)	Class 2 n = 187 (7.1 %)	Class 3 n = 195 (7.4 %)	Class 4 n = 121 (4.6 %)	Class 5 n = 48 (1.8 %)	Class 6 n = 34 (1.3 %)	Group Comparison (Chi Square or ANOVA)
Cardiovascular disorder (s)	334 (13)	260 (13)	14 (8)	26 (14)	15 (13)	8 (17)	11 (32)	X^2 (5,N = 2577) = 16.66, $p < 0.05$
Gastrointestinal disorder(s)	347 (13)	243 (12)	25 (14)	40 (21)	17 (15)	12 (26)	10 (29)	X^2 (5,N = 2577) = 25.44, $p < 0.001$
Liver disorder(s)	138 (5)	106 (5)	6 (3)	16 (8)	2 (2)	3 (6)	5 (15)	X^2 (5,N = 2577) = 13.97, $p < 0.05$
Urogenital disorder(s)	271 (11)	187 (9)	21 (11)	29 (15)	16 (14)	8 (17)	10 (29)	X^2 (5,N = 2577) = 23.72, $p < 0.001$
Metabolic disorder(s)	359 (14)	267 (13)	22 (12)	23 (12)	29 (25)	7 (15)	11 (32)	X^2 (5,N = 2577) = 22.94, $p < 0.001$
Skin disorder(s)	318 (12)	240 (12)	25 (14)	24 (13)	17 (15)	5 (11)	7 (21)	X^2 (5,N = 2577) = 3.33, $p = 0.650$
Musculoskeletal disorder(s)	412 (16)	293 (15)	36 (20)	45 (23)	16 (14)	8 (17)	14 (41)	X^2 (5,N = 2577) = 29.14, $p < 0.001$
Gynaecological disorder(s)	241 (4)	174 (9)	22 (12)	21 (11)	11 (9)	6 (13)	7 (21)	X^2 (5,N = 2577) = 8.86, $p = 0.114$
Allergies	791 (31)	549 (27)	84 (46)	75 (39)	43 (37)	25 (53)	15 (44)	X^2 (5,N = 2577) = 52.55, $p < 0.001$
Chronic pain	813 (32)	565 (28)	58 (32)	96 (50)	51 (44)	23 (49)	20 (59)	X^2 (5,N = 2577) = 66.86, $p < 0.001$
Psychological disorder (s)†	489 (19)	294 (15)	48 (26)	66 (34)	41 (35)	26 (55)	14 (41)	X^2 (5,N = 2577) = 130.96, $p < 0.001$
Above BSI cut-off	487 (18)	286 (14)	57 (30)	62 (32)	39 (32)	24 (50)	19 (56)	X^2 (5,N = 2642) = 148.13, $p < 0.001$
Above ETI cut-off	394 (15)	202 (10)	40 (21)	44 (23)	59 (49)	25 (52)	24 (71)	X^2 (5,N = 2642) = 301.79, $p < 0.001$

Notes. †As indicated by Germain Pain German Pain Questionnaire (Association GP, 2015).

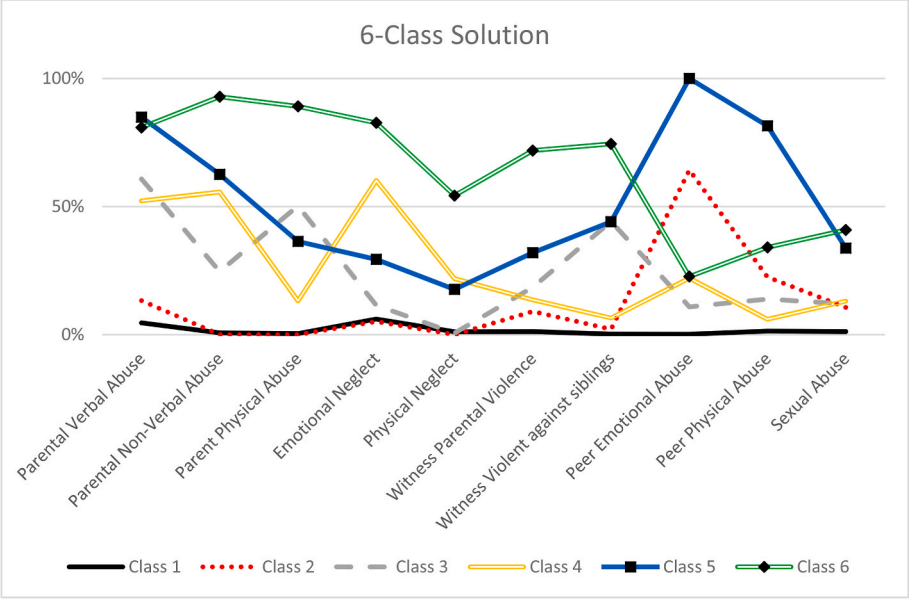

Fig. 1. Graphical representation of the 6-class solution.

of the sample and were young, likely single, living alone, and had the highest BSI scores across classes.

Class 6: Parental abuse and neglect

This class was highly likely to report parental abuse (verbal, non-verbal, and physical), emotional and physical neglect, as well as having witnessed parental violence and/or violence against siblings. They were the most likely class to report sexual abuse. This class, consisting of just over 1% of the sample, were older than the other classes, mostly female, had a high prevalence of people living with family/friends, and had the highest average ETI scores.

3.3. Regression models

The results (presented in Table 2) showed that all classes, compared to Class 1, were associated with an increased likelihood of one or more health conditions. Class 2 (bullied emotionally) was more likely to experience musculoskeletal disorders and allergies. Class 4 (emotional neglect) had a higher likelihood of metabolic disorders. Class 3 (difficult homes) was more likely to report gastrointestinal, urogenital, and musculoskeletal disorders, as well as allergies. Class 5 (parental and peer bullying) had higher odds of respiratory, gastrointestinal, and urogenital disorders, in addition to allergies. Class 6 (parental abuse and neglect) had a higher likelihood of neurological, cardiovascular, gastrointestinal,

Table 2
Adjusted odds ratios of reporting physical and mental health conditions between Classes 2–5 vs Class 1 (minimal ACEs).

	Total Sample	Class 2: Bullied emotionally Class 2 (vs Class 1)	Class 3: Difficult homes Class 3 (vs Class 1)	Class 4: Emotional neglect Class 4 (vs Class 1)	Class 5: Parental and peer bullying Class 5 (vs Class 1)	Class 6: Parental abuse and neglect Class 6 (vs Class 1)
	n (%)	aOR [95 % CI]	aOR [95 % CI]	aOR [95 % CI]	aOR [95 % CI]	aOR [95 % CI]
Physical disorders	1778 (67.3)	1.96 [1.38–2.79]***	2.09 [1.45–3.00]***	1.99 [1.27–3.11]**	2.36 [1.16–4.79]*	8.59 [2.04–36.0]**
Cancer	353 (14)	0.57 [0.3–1.08]	1.10 [0.73–1.68]	1.25 [0.74–2.12]	1.07 [0.41–2.81]	1.00 [0.38–2.66]
Neurological disorders	398 (15)	1.34 [0.3–1.08]	1.13 [0.75–1.69]	1.59 [0.99–2.55]	0.95 [0.4–2.27]	2.55 [1.2–5.41]*
Respiratory disorders	407 (16)	1.42 [0.95–2.12]	1.21 [0.82–1.8]	1.20 [0.73–1.98]	2.86 [1.52–5.39]**	2.12 [0.98–4.61]
Cardiovascular disorders	334 (13)	0.78 [0.44–1.39]	1.07 [0.69–1.67]	1.07 [0.61–1.9]	1.90 [0.86–4.21]	3.52 [1.66–7.47]**
Gastrointestinal disorders	347 (13)	1.20 [0.77–1.89]	1.86 [1.28–2.71]**	1.19 [0.69–2.03]	2.60 [1.32–5.12]**	2.93 [1.38–6.24]**
Liver disorders	138 (5)	0.77 [0.33–1.8]	1.62 [0.93–2.81]	0.33 [0.08–1.36]	1.53 [0.46–5.08]	3.11 [1.17–8.29]*
Urogenital disorders	271 (11)	1.56 [0.95–2.55]	1.68 [1.1–2.59]**	1.49 [0.85–2.6]	2.46 [1.11–5.44]*	4.00 [1.85–8.62]***
Metabolic disorders	359 (14	1.05 [0.65–1.69]	0.84 [0.53–1.33]	2.02 [1.28–3.16]**	1.33 [0.58–3.05]	2.93 [1.39–6.19]**
Skin disorders	318 (12)	1.16 [0.74–1.82]	1.07 [0.68–1.68]	1.25 [0.73–2.14]	0.86 [0.34–2.21]	1.96 [0.84–4.57]
Musculoskeletal disorders	412 (16)	2.08 [1.39–3.12]***	1.78 [1.24–2.57]**	0.94 [0.54–1.64]	1.69 [0.76–3.75]	4.17 [2.03–8.58]***
Gynaecological disorder	241 (4	1.57 [0.96–2.56]	1.17 [0.72–1.9]	0.96 [0.50–1.84]	1.68 [0.69–4.11]	2.41 [1.01–5.75]*
Allergies	791 (31)	1.92 [1.41–2.63]***	1.70 [1.25–2.32]**	1.45 [0.98–2.15]	2.64 [1.47–4.75]**	2.08 [1.04–4.16]*
Chronic pain	813 (32	1.50 [1.07–2.09]*	2.60 [1.92–3.52]***	2.05 [1.39–3.03]***	3.14 [1.73–5.89]***	3.65 [1.81–7.36]***
Psychological disorders	489 (19)	2.07 [1.45–2.97]***	2.99 [2.16–4.14]***	2.96 [1.98–4.43]***	7.49 [4.13–13.58]***	3.76 [1.87–7.56]***
Above GSI cut-off	487 (18)	2.31 [1.57–3.4]***	2.62 [1.81–3.79]***	8.12 [5.5–11.99]***	9.55 [5.29–17.26]***	21.06 [9.89–44.85]***
Above ETI cut-off	394 (15)	2.43 [1.73–3.42]***	2.88 [2.07–4.0]***	2.79 [1.86–4.19]***	5.62 [3.13–10.08]***	7.73 [3.86–15.45] ***

Notes. aOR = adjusted Odds Ratio (adjusted for age and gender) of reporting a given disorder/condition for members of an individual Class, compared to the base Class (Class 1: minimal ACEs). 95 % CI = 95 % Confidence Intervals. *p < 0.05, **p < 0.01, ***p < 0.001.

liver, urogenital, metabolic, musculoskeletal, and gynaecological disorders, as well as allergies. Significantly, all classes had increased odds of chronic pain conditions and psychological conditions compared to Class 1 and were more likely to score above the clinical thresholds on the GSI and ETI.

Findings, as presented in Appendix D, revealed various differences between the likelihood of reporting specific health conditions. Compared to Class 4 (emotional neglect), Class 2 (emotionally bullied) were less likely to report metabolic disorders and significant trauma on the ETI but were more likely to report musculoskeletal conditions. Class 3 (difficult homes) was more likely to report liver problems but, similar to Class 2, less likely to report metabolic disorders or trauma on the ETI. Class 5 (parental and peer bullying) was more likely to report respiratory and psychological conditions, with cut-offs on the BSI more likely to be above the clinical threshold compared to Class 4, but the likelihood of reporting trauma on the ETI did not differ between these two classes. Lastly, Class 6 (parental abuse and neglect) was more likely to report cardiovascular, liver, urogenital, and musculoskeletal disorders, and more likely to report significant levels of mental distress on the BSI or trauma on the ETI, compared to Class 4.

4. Discussion

The present study used LCA to uncover distinct subgroups of co-occurring adverse childhood experiences (ACEs). We then examined the associations between these classes and the likelihood of reporting a variety of physical and mental health conditions. Six distinct classes were identified, the largest of which reported minimal ACEs (Class 1, 78%). Other classes were characterized by peer emotional abuse (Class 2, 7%), physical abuse and witnessing violence at home (Class 3, 7%), emotional neglect at home (Class 4, 5%), verbal abuse at home and abuse from peers (Class 5, 2%), and receiving and witnessing verbal and physical abuse at home (Class 6, 1%). Compared to the class with minimal ACEs, all other classes were at a heightened risk of reporting significant mental health issues. Relative to Class 4 (emotional neglect), Classes 2 and 3 were less likely to report trauma on the ETI, but Class 6 was more likely, and Class 5 was more likely to report significant mental distress. Metabolic conditions appear more common in individuals reporting emotional neglect when compared to those without ACEs or those reporting peer bullying or home physical abuse (without other ACEs). Class 6 was at significantly increased risk of several physical conditions, including cardiovascular, liver, urogenital, and musculoskeletal disorders, compared to other classes.

Our study identified six classes of individuals based on their ACE patterns, which is more than typically reported in prior analyses where four or five classes are most common (Bussemakers et al., 2019; Wolff et al., 2018). This discrepancy might be partly due to our focus on a physically ill sample. Past analyses usually identified subgroups with no or limited ACEs reported, those with multiple ACEs, groups reporting mainly household dysfunction, and a group reporting maltreatment (Witt et al., 2019). Our study differs by providing more detailed information on ACE types, distinguishing both emotional and physical abuse at home and from peers, whereas most prior studies did not divide 'emotional abuse' by its origin. The identification of classes based solely on abuse from peers (e.g., Class 2) in our study could explain the differences in findings compared to previous research, where measures of peer-related ACEs have not been included. Our findings suggest these ACEs may be particularly important to consider in future studies. It is noteworthy that studies using general population samples have found the 'minimal ACEs' group to comprise approximately 80 % of the sample, indicating that most individuals report not experiencing ACEs, and possibly characterizing our sample as slightly higher risk. However, it should be noted that proportion of ACEs reported between studies is variable, with some reporting population prevalence of 'zero ACEs' as low as 40 % (Afifi et al., 2014). The differences in results may be due to the presenting samples, measures of ACEs and further research considering geographical and demographic factors would be valuable to further understand these differences.

Prior analyses have not delved into differences in healthcare conditions between identified classes of individuals based on ACEs, but our findings hint at the potential value of a more nuanced approach when examining the risk of subsequent health conditions according to ACE clusters. Previous studies have shown that having four or more ACEs is associated with higher odds of conditions such as respiratory, urogenital, and musculoskeletal disorders compared to having minimal ACEs, and even reporting between one and three ACEs confers a greater risk of these physical illnesses (Riedl et al., 2020). However, our findings suggest that specific constellations of ACEs might be linked to specific disorders. Whilst previous research has not examined the association between ACE subgroups and the presence of specific physical health conditions, there is some evidence that specific ACEs might differentially contribute to specific inflammatory profiles, which in turn might manifest as different somatic complaints (Herzog and Schmahl, 2018). As an example, emotional abuse has been linked to increased pain reporting and touch sensitivity (Tesarz et al., 2016). Further, that the parental and peer bullying subgroup (Class 5) were experiencing adversity both within and out of the home may have led to negative coping behaviours such as smoking, which in turn could have explained the higher risk of respiratory behaviours in this group (Lopes et al., 2020). Although our findings are exploratory, they might support further investigations of the processes involved in the development of such disorders and spur more research into the mechanistic understanding of these pathways. Repeated stress resulting from ACEs has been implicated in the dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis, which is associated with an increased risk of illness (Kalmakis et al., 2015). As such, more research into the interplay of pathophysiological mechanisms linked to alterations in the immune system, HPA axis functioning, and neuromodulatory and epigenetic processes (Cecil et al., 2020) would be extremely valuable. Additionally, it has been suggested that the experience of early adversity can significantly impact help-seeking behavior and social learning, compromising the adequate use of professional mental and physical health support systems. This lack of epistemic trust (Fonagy and Allison, 2014) can affect help-seeking across the spectrum from engagement in prevention to treatment and follow-up, and even broader social support.

4.1. Limitations

The current analysis identified co-occurring clusters of ACEs reported in patients' childhoods. However, it did not explore whether there was variation in when these ACEs occurred, or whether co-occurrences differed during childhood and adolescence. It would be interesting to examine in future research whether the sequencing of certain ACEs occurring before others impacted the later development of both mental and physical illness. Furthermore, the cross-sectional design of this study means that the findings are associative rather than causal, but it may stimulate further longitudinal research exploring the links between ACEs and later health outcomes. Claims around generalisability should also be made in the context of the self-selected convenience sample that is used here. It is unknown whether other life events may have impacted the physical and mental health reported in the current study, and while we controlled for age in the models, there may be generational differences that were not examined in this analysis. All measures used in this study, including ACEs as well as mental and physical health variables, were self-reported. Therefore, there is potential for participants to have responded inaccurately to any of the explored factors, or to have misremembered certain events. As individuals were recruited in waiting rooms for examinations, they may have recorded medical conditions before confirmation. Future analyses might consider using healthcare records to provide additional information about medical conditions. The small size of some classes, especially Classes 5 and 6, made comparisons between distal variables difficult, and meant that employing modelling approaches that can account for the uncertainty in class membership could not be estimated with the current data. These three-step approaches (Asparouhov and Muthén, 2014) have a number of benefits in estimating differences in distal outcomes, and future studies should consider targeting recruitment around members of less prevalent ACE subgroups to increase statistical power.

4.2. Implications

ACEs are associated with adversities that can significantly impact an individual's ability to relate to others and form relationships (Huang et al., 2020). Childhood neglect has also been linked to diminished epistemic trust, or the capacity of an individual to accept information from others, which is established in childhood through parent-child interactions (Campbell et al., 2021). This can have potentially detrimental consequences for adults with ACEs, as such experiences may result in distrust of others, including clinicians and healthcare systems, leading to hesitance or failure to seek treatment when needed or to adhere to routine check-up guidance. Developing strategies to engage individuals with a history of ACEs in routine prevention and check-ups, and supporting them in making clinical decisions could lead to improved outcomes for this group. The fact that different ACE groupings were associated with varying risk levels for specific conditions might lead to more targeted and personalized support for individuals.

5. Conclusion

This study identified six subgroups of individuals based on their reported ACEs using latent class analysis. The largest group reported minimal ACEs, and other groups differed based on the type of abuse reported (physical, verbal, or emotional) and the source of the abuse (home or peers). Groups were differentially associated with the likelihood of reporting various health conditions later in life, with particularly notable distinctions for metabolic, urogenital, and musculoskeletal disorders. The likelihood of significant mental health issues and trauma (as reported on the ETI) was considerably higher in the group reporting physical, emotional, and verbal abuse, and witnessing abuse at home. Trauma on the ETI was more likely to be reported in the group experiencing emotional neglect compared to groups reporting solely emotional abuse from peers. Further research into the association between these clusters of ACEs and risk of specific conditions is warranted. However, the current findings underscore a potential role for targeted prevention work and implementation of integrated mental and physical healthcare pathways for individuals who have experienced ACEs.

CRediT authorship contribution statement

Rob Saunders: Writing – original draft, Software, Methodology, Formal analysis, Conceptualization. **Tobias Nolte:** Writing – review & editing, Methodology, Conceptualization. **Tom G. Osborn:** Writing – review & editing, Visualization. **Henry Delamain:** Writing – review & editing, Methodology, Formal analysis. **David Riedl:** Writing – review & editing, Data curation. **Peter Fonagy:** Writing – review & editing, Supervision, Methodology. **Astrid Lampe:** Writing – review & editing, Investigation, Conceptualization.

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Declaration of competing interest

None to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychires.2025.05.024.

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