



## Childhood adversity patterns differentially cluster with mental disorders and socioeconomic indicators in a large Swiss community sample

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### ABSTRACT

**Background:** Exposure to childhood adversities (CHAD) has been found to be strongly associated with individuals' mental health and social development. Recently, it has been suggested that certain CHAD patterns exist in the population, which are more closely related to individuals' later mental health than the simple summation of adversities. The current study aims 1) to establish CHAD patterns based on self-reported child abuse and family dysfunction and 2) to assess their associations with mental disorders and sociodemographic indicators reported in adulthood.

**Methods:** Data used in this cross-sectional study were derived from the representative CoLaus/PsyCoLaus population-based cohort ( $N = 5111$ , 35 to 88 years). Latent class analysis was conducted for the identification of CHAD patterns, while their associations with mental disorders and socioeconomic achievements (e. g. education and income) were investigated using correspondence analysis.

**Results:** Four CHAD patterns emerged. While the majority (70.7%) of the sample showed an overall low adversity pattern (c1), 13.6% had not been raised by both of their biological parents due to divorce or being placed in foster home (c2), 11.0% had been raised by conflictive / dysfunctional / abusive parents (c3), and 4.7% showed high overall adversities (c4). Patterns c3 and c4 were most strongly associated with various mental disorders, especially c3 with internalizing anxiety disorders, while c2 was closely related to lower educational achievement. **Conclusions:** Four CHAD patterns characterised by varying levels of child abuse and family dysfunction existed in this community sample. They yielded distinct associations with mental disorders and socioeconomic indicators.

### 1. Introduction

Exposure to childhood adversities (CHAD), such as emotional, physical and sexual abuse or neglect, was shown to be strongly associated with mental health across the individual's lifespan [16,23]. CHAD exposure increases the risk for a broad range of mental health problems in adulthood, including depression [8,38], anxiety [21], post-traumatic stress disorder [47], substance use disorders [13,32] and suicidality [5]. Even though less understood, recent studies began to explore the relationship between CHAD exposure and socioeconomic achievements, such as education, income and employment in adulthood, instead of

controlling for them as personal attributes [31,37]. Specifically, higher CHAD exposure was associated with increased rates of unemployment, school non-completion and poverty [31,37].

Many studies showed that there is a dose-response relationship between the number of CHAD and poor mental health outcomes in adulthood [4,8,16,23,25]. On the other hand, a growing body of literature has suggested that different patterns of CHAD exist among populations [12,42]. For example, two of the most commonly identified classes were those with no/low adversity or high overall adversities. A general observation was that compared to the no/low adversity class, those characterised by a certain subtype of CHAD showed higher levels

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of behavioral problems and health impairment. A few studies showed that different patterns of CHAD exhibited significant differences in their associations with health outcomes [1,10,20]. It was suggested certain CHAD patterns might be implicated in specific health problems. For instance, Lanier et al. [27] showed that children exposed to poverty and parental mental illness were at the highest risk for special healthcare needs among all the CHAD pattern groups, including the one with the highest co-occurred adversities [27]. Compared to simple summation, specific patterns or combinations of CHAD could be more efficient in explaining behavioral and mental health outcomes [10]. Identification of CHAD patterns could thus benefit our prevention and treatment of mental disorders by addressing each subgroup's specific needs and tailor personalized prevention and treatment options accordingly.

There are different categories of CHAD, including child maltreatment and family dysfunction [16]. Most CHAD pattern studies focused on various forms of child maltreatment, such as physical, emotional and sexual abuse or neglect [10,12,22,42]. On the other hand, family dysfunction, such as domestic violence and parental mental illness, was highly correlated with child abuse/neglect and was shown to be predictive of long-term mental health problems [21,29]. Domestic violence was even shown as one of two most important risk factors for anxiety disorders, along with child sexual abuse [11]. However, family dysfunction factors were rarely included in these CHAD pattern studies.

Furthermore, the vast majority of these CHAD pattern studies were carried out on restricted samples, namely children or youth at risk [12,42]. Investigations carried out on randomly selected community samples, especially those with inclusion of family function items and a broad age range, are scarce [10,22]. Among them, Haahr-Pedersen et al. [22] identified two extra classes among women characterised by either child maltreatment or family dysfunction, besides the low or high adversity classes, which were shared by both sexes. This suggested that sex-specific patterns of CHAD might exist among populations.

Using data from a large community sample, the present study aimed to: 1) identify CHAD patterns based on child abuse and family dysfunction according to latent class analysis (potentially sex-specific CHAD patterns) and 2) determine the associations of the established CHAD patterns with the lifetime prevalence of mental disorders and sociodemographic characteristics in adulthood, as measured by marital status, income level and educational achievement. Due to the inclusion of family dysfunction factors, we expected our analysis could render new patterns of CHAD and they could be sex specific. Furthermore, profiles/clustering of the associations between these CHAD patterns and various mental disorders could be clinically informative for evidence-based treatments.

## 2. Methods

### 2.1. Study participants and design

The sample used for the present cross-sectional analyses was derived from the randomly selected community cohort of CoLaus|PsyCoLaus [17,40], which explores associations between mental disorders and cardiovascular diseases and risk factors. The first assessment of a total of 5111 participants (range 35 to 88 years) was included in the current analyses. The CoLaus|PsyCoLaus study was approved by University of Lausanne's Institutional Ethics Committee (first approval numbers were 16/03 (CoLaus, the physical evaluation) and 187/03 (PsyCoLaus, the psychiatric evaluation)) [40]. All participants received a detailed description of the goals, procedures and funding of the study and signed a written informed consent form. Suppl. 5 described the cohort study in more details.

### 2.2. Measures

The psychiatric evaluation was carried out in a face-to-face setting by trained psychiatrists and psychologists with the French version [39] of

the semi-structured Diagnostic Interview for Genetic Studies (DIGS) [34].

### 2.3. Childhood adversities

Childhood adversities (below the age of 16) were assessed by questions of childhood events from the Schedule for Affective Disorders and Schizophrenia-Lifetime Version [15,18,30], a modified version originally used in the Yale Family Study [30] for collecting more detailed lifetime information. The following nine items of CHAD were assembled: overall childhood happiness ('In general, how was your childhood: happy, neither happy nor unhappy, unhappy, or quite unhappy?'), not being raised by both biological parents ('Did you live with your biological parents until the age of 16?'), divorced/separated parents ('Did your parents separate or divorce?'), being placed in a foster home ('Were you put in a children's home or in another family?'), loss of significant others (not parents), depressed father (depression with impact on work or resulted in hospitalization), depressed mother (depression with impact on work or resulted in hospitalization), interparental violence (fighting parents), child abuse ('Did your parents ever do anything that frightened you (like locking you in a closet)?')

### 2.4. Mental disorders and sociodemographic factors

Diagnostic criteria for mental disorders and suicidal behavior [40] were elicited using a semi-structured interview, which is described more in details in Suppl. 5. Diagnoses were assigned according to the Diagnostic and Statistical Manual of Mental Disorders (DSM)-IV. Common mental disorders (CMDs) assessed consisted of 1) early-onset anxiety disorders, which normally start during childhood, i.e., separation anxiety, simple phobia and social phobia, 2) late-onset anxiety disorders, which normally start after adolescence, i.e., agoraphobia, generalized anxiety disorder and panic disorder, 3) migraine, 4) mood disorders, i.e., major depressive disorder, bipolar disorder (types I&II), dysthymic disorder, 5) obsessive compulsive disorder, 6) post-traumatic stress disorder (PTSD), 7) neurodevelopmental disorders, i.e., attention deficit hyperactivity disorder (ADHD), conduct disorder, and oppositional defiant disorder, 8) substance (alcohol/drug) use disorders (both abuse and dependence) and 9) suicidality (suicide attempts). In addition, besides age and sex, information on a participant's current socioeconomic status, as measured by marital status (married versus not), annual income, and the highest level of education, was also collected. Table 1 provides a detailed description of these socioeconomic indicators.

### 2.5. Analysis design and statistics

Overall, there are two steps of analysis in the current study. First, latent class analysis (LCA) was used to explore the potential CHAD

**Table 1**  
Sample characteristics (n = 5111).

		N	Percentage
Age	Years	54.7 ± 11.5 (mean ± SD)	
Sex	Women	2741	53.6%
Marital status	Married	2938	57.5%
	<30,000	326	6.4%
Annual income (CHF)	30,000–49,999	817	16.0%
	50,000–69,999	1077	21.1%
	70,000–80,999	933	18.3%
	90,000–110,000	638	12.5%
	>110,000	963	18.8%
Highest level of education*	Basic level	2754	53.9%
	Middle level	1182	23.1%
	University or above	1041	20.4%

Abbreviations: N, counts; SD, standard deviation.

\* Basic level: compulsory school or apprenticeship; Middle level: upper secondary school or higher education except for university.

patterns. The LCA model selection was first based on the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) [35], with lower information criterion values indicating better fitting models. Since AIC tended to overestimate and BIC to underestimate the class numbers [14], they were better suited for model exclusion instead of for single model selection [9,14,24]. Specifically, we used AIC to indicate a maximum number of classes, and BIC, a minimum number of classes. As a result, potentially best-fitting model(s) were selected by such an exclusion procedure for further decision. A Bootstrap likelihood ratio test (Bootstrap LRT) was shown to perform robustly under varying situations for model comparison [35,46]. It was referenced for further selection in case of multiple potential models. In the final step, the differentiation, size and theoretical adequacy of the classes were examined.

Next, logistic regression and Kruskal-Wallis H tests were used to examine the associations between the CHAD patterns and each mental disorders. Correspondence analysis (CA) was used as the statistical tool for systematic and graphical summarization of these contingency tables [2,7,43]. For CA, the aggregated CMD variables as described in the measures section 2.2, were used. As an exploratory multivariate technique, CA resembles the principal component analysis (PCA). In CA, dimensions were extracted according to the  $\chi^2$  distance (analogous to the Euclidian distance in PCA). A minimum number of dimensions, normally the first one or two, are extracted to present the maximum amount of inertia (comparable to PCA's total variance) and to portray the results on the correspondence maps. Scores on these dimensions account for the distances from the average row to the column profile (i.e., the CHAD pattern and the mental disorder profile, respectively). The distance between any pair of points is comparable to the weighted Euclidian distance. For the interpretation of the CA results, i.e. the comparison of distances between different variables, it is preferable to focus on similar directions from the zero point and examine the distance from the zero point individually for each variable [2]. Overall, the CA provides a global picture of the associations between the row-column pairs and thus facilitates the search for potential patterns that could easily be missed using traditional pair-wise analyses.

Latent class analysis was carried out in Latent GOLD® 5.1, while other data processing and analyses were carried out in IBM® SPSS® Statistics 25.0.

### 3. Results

#### 3.1. Characteristics of the sample

Table 1 provides a detailed description of the sample. The prevalence of the 9 CHAD indicators is described in Table 2, for the total sample and the sex-stratified subsamples. The top four most frequent indicators in the total sample were loss of significant others (not parents) (36.3%), not having been raised by both biological parents (26.6%), interparental

violence (12.5%) and having had divorced/separated parents (12.4%). There were significant sex differences among 3 out of the 9 indicators. Women were more likely than men to report an unhappy childhood, a depressed mother, and childhood abuse.

#### 3.2. Patterns of childhood adversities

The LCA suggested a four-class solution (Suppl. 3) for the total sample (Fig. 1): c1, low overall adversities (70.7%, low adversities class); c2, not having been raised by both biological parent(s) due to parental divorce / separation or by being placed in a foster home (13.6%, separation class); c3, raised by conflictive/dysfunctional/abusive biological parents (11.0%, conflict-abuse class); c4, high overall adversities with a combination of all CHAD indicators (4.7%, high adversities class). Similarly, four CHAD patterns were derived from the subsamples of women (Suppl. 1 and 3) and men (Suppl. 2 and 3), whose configurations resembled those of the total sample (Fig. 1). However, the percentages of respective patterns were significantly different between the two sexes (Suppl. 4), with higher portions of c1 (low adversities class) and c2 (separation class), and lower portions of c3 (conflict-abuse class) and c4 (high adversities class) in men than in women (Suppl.4). In summation, the configurations of CHAD patterns among women resembled those of men, even though there were certain numeric differences between the corresponding pattern' percentages. In other words, the childhood adversity patterns of the two sexes differed by quantity but not by quality. Further analysis was based on the childhood adversity patterns that stemmed from the whole sample.

#### 3.3. Associated mental health and socioeconomic outcomes

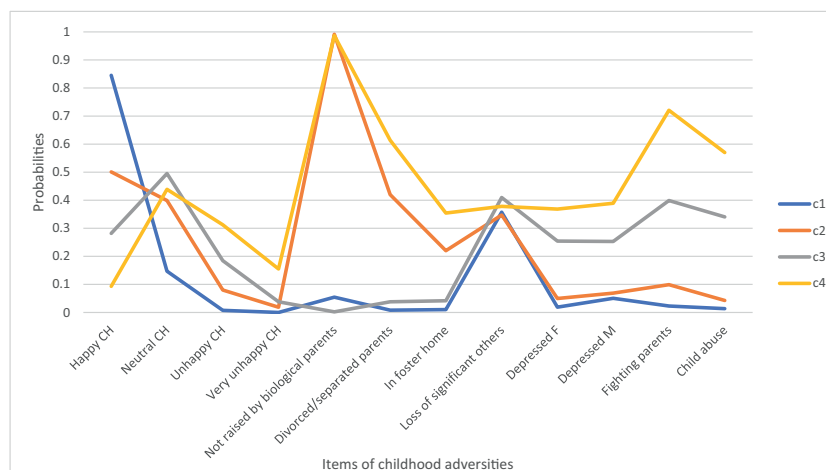
Table 3 shows that compared to the low adversity class c1, the conflict-abuse class c3 (with the exceptions of agoraphobia and education) and the high adversities class c4 (with the exceptions of dysthymic disorder and generalized anxiety disorder) showed overall worse mental health and socioeconomic achievement. The separation class c2, on the other hand, increased the risk for part of the mental disorders, especially for externalizing neurodevelopmental disorders (such as conduct disorder and oppositional defiant disorder) and substance use disorders.

Generally, the high adversities class c4 showed a higher risk than the conflict-abuse class c3 for mental disorders. Exceptionally, with generalized anxiety disorder and dysthymic disorder, the conflict-abuse class c3 showed the highest odds ratios among all four CHAD patterns. Likewise, the CHAD pattern c3 generally manifested higher odds ratios of mental health problems than the separation class c2, especially for early-onset anxiety disorders (such as separation anxiety disorder, simple phobia and social phobia), despite similar amounts of adversities. However, exceptions existed for conduct disorder, oppositional defiant disorder and agoraphobia, for which the separation class c2 was

**Table 2**  
Prevalence of childhood adversities until the age of 16 years stratified by sex.

	Total		Men		Women		$\chi^2$	p	
	N	Percentage	N	Percentage	N	Percentage			
Overall childhood happiness	Happy	3339	66.4%	1637	70.1%	1702	63.1%	46.61	0
	Neutral	1278	25.4%	564	24.2%	714	26.5%		
	Unhappy	313	6.2%	102	4.4%	211	7.8%		
	Very unhappy	100	2.0%	31	1.3%	69	2.6%		
Not raised by both biological parents	3698	26.6%	1746	25.3%	1952	27.7%	3.48	0.062	
Divorced/separated parents	620	12.4%	284	12.2%	336	12.5%	0.12	0.728	
In foster home	389	7.8%	163	7.0%	226	8.5%	3.56	0.059	
Loss of significant others (other than parents)	1827	36.3%	841	36.0%	986	36.6%	0.18	0.676	
Depressed F	360	7.4%	154	6.8%	206	7.9%	2.45	0.118	
Depressed M	514	10.4%	173	7.5%	341	12.9%	38.47	0	
Interparental violence	624	12.5%	273	11.8%	351	13.1%	2.04	0.153	
Child abuse	475	9.5%	193	8.3%	282	10.5%	7.04	0.008	

Abbreviations: F, father; M, mother.



**Fig. 1.** Patterns of childhood adversities in the total sample.

Abbreviations: CH, childhood; F, father; M, mother. c1, the low adversities class; c2, the separation class; c3, the conflict-abuse class and c4, the high adversities class. Note: The probabilities of the items were connected by lines to facilitate examination of the LCA results.

associated with higher risks.

Next, to systematically and graphically investigate the associations between these indicators of mental health or socioeconomic performance and the CHAD patterns, CA was carried out with the aggregated CMD variables. The correspondence map in Fig. 2. showed most of the anxiety and mood disorders to share the direction of the conflict-abuse CHAD pattern c3. Meanwhile, externalizing disorders, namely, neurodevelopmental disorders, substance use disorders and suicidality mostly shared the direction of CHAD pattern c4 the high adversities class. CHAD pattern c2 the separation class, shared the same direction with the high adversities class c4, even though the former was far closer to the zero point than the latter. Similar results were observed for an alternative analysis where latent classes of CMDs were identified and a two-factor CA was carried out (only shown in Suppl. 6.).

In the CA map of socioeconomic indicators (Fig. 3.), the CHAD pattern c2 (separation class) fell into a different direction from c3 (conflict-abuse class) and c4 (high adversities class). While c2 (separation class) was closely but negatively related to the achievement of education, c3 (conflict-abuse class) and c4 (high adversities class) were mostly implicated with an individual's marital status.

#### 4. Discussion

In this analysis of a large and representative Swiss community sample, two methodological approaches were combined, LCA for CHAD pattern identification and CA for the clustering of associated mental disorders and socioeconomic indicators. Four patterns of childhood adversities were identified, i.e., a low adversity class (c1), separation class (c2), conflict-abuse class (c3) and high adversities class (c4). Compared to c1, the other three classes were associated with worse mental health and social performances, especially c3 and c4. Furthermore, despite similar amounts of adversities within CHAD patterns c2 (separation class) and c3 (conflict-abuse class), c3 (conflict-abuse class) was associated with higher levels of mental health problems, especially early-onset anxiety disorders. The CA results further confirmed that the mental disorders were incongruously related to the CHAD patterns, with only c3 (conflict-abuse class) and c4 (high adversities class) showing strong associations with most of the common mental disorders.

##### 4.1. CHAD patterns and differences by sex

Four similar patterns of childhood adversities were identified in both men and women. The majority of the sample showed an overall low adversity CHAD pattern (c1). Moderate portions of the sample either

had not been raised by both of the biological parents (c2, separation class) or had been raised by conflictive/dysfunctional/abusive biological parents (c3, conflict-abuse class), while a small percentage of the sample exhibited high overall adversities (c4). In all, these findings were consistent with previous observations that specific configurations of CHAD existed among population samples [10,11,22,42] and it further expanded the findings by inclusion of family dysfunction factors.

More specifically, CHAD pattern c1 (low adversity class) and c3 (conflict-abuse class) were similar to those established by Haahr-Pedersen [22] and Curran [10] in their population samples. However, c2 (separation class) and c4 (high adversities class) were unique here since neither of these two studies included the family dysfunction items of not being raised by both biological parents and being placed in a foster home.

Interestingly, no different patterns of CHAD were identified among the two sex-specific subsamples, in contrast to the previous finding that women had more complex patterns of CHAD than men [22]. To be more specific, Haahr-Pedersen et al. established only the low adversity and the high adversity CHAD profiles in men but two moderately loaded extra CHAD profiles in women, namely the child abuse-neglect and the family dysfunction profiles. There were two potential explanations for this inconsistency. First, the sample sizes were different, with 5111 in the present study compared with 1839 in Haahr-Pedersen et al.'s study. One of the tendencies of the LCA methodology is that the bigger the sample size, the better the information criteria (ICs) are at predicting the relative large class numbers [35]. Therefore, the lack of the two moderately loaded CHAD patterns in men when compared to women in Haahr-Pedersen et al.'s study could be due to the smaller sample size. Secondly, different sets of CHAD indicators were involved. For example, Haahr-Pedersen et al.'s study included CHAD items of not only child abuse but also neglect. Yet, the latter items were absent in the present study, which was further discussed in the limitations.

However, quantitative differences did exist between the two gender subsamples in our results, where women were more likely to experience a harsh childhood (CHAD pattern c3/c4 instead of c1/c2). This was reflected by observations related to the individual CHADs, where women reported more incidences of an unhappy childhood, a depressed mother and childhood abuse. These results were consistent with existing evidences which showed that women are more likely than men to report experiences of childhood abuse [19,22,44] and mental illness of the family members within the house hold [22].

**Table 3**  
Frequencies/means of mental disorders and socioeconomic indicators across CHAD patterns.

	CHAD patterns				Total N (percentage)	Statistics					
	c1	c2	c3	c4		c2 VS c1		c3 VS c1		c4 VS c1	
	N (percentage)	N (percentage)	N (percentage)	N (percentage)		OR(95%CI)	p-value	OR(95%CI)	p-value	OR(95%CI)	p-value
Total	3352 (70.7%)	645(13.6%)	523(11.0%)	222(4.7%)	4742 (100.0%)	-	-	-	-	-	-
ADHD	49(1.5%)	14(2.2%)	16(3.1%)	15(6.9%)	94(2.0%)	1.51 (0.83–2.75)	0.179	2.30 (1.29–4.08)	0.005	5.28 (2.90–9.60)	0.000
AGO	99(3.0%)	32(5.0%)	24(4.6%)	14(6.4%)	169(3.6%)	1.70 (1.13–2.56)	0.011	1.45 (0.92–2.30)	0.111	2.10 (1.17–3.74)	0.013
BP	35(1.0%)	8(1.2%)	16(3.1%)	9(4.1%)	68(1.4%)	1.20 (0.55–2.59)	0.652	3.10 (1.70–5.65)	0.000	4.10 (1.94–8.66)	0.000
CD	47(1.4%)	30(4.7%)	17(3.3%)	17(7.8%)	111(2.4%)	3.54 (2.21–5.66)	0.000	2.80 (1.59–4.95)	0.000	6.84 (3.81–12.25)	0.000
DD	95(2.8%)	31(4.8%)	28(5.4%)	11(5.0%)	165(3.5%)	1.72 (1.14–2.61)	0.010	1.85 (1.20–2.86)	0.005	1.73 (0.91–3.29)	0.093
GAD	54(1.6%)	19(3.0%)	25(4.8%)	6(2.7%)	104(2.2%)	1.84 (1.08–3.13)	0.024	2.93 (1.81–4.76)	0.000	1.65 (0.70–3.88)	0.252
MDD	1184 (35.3%)	297(46.0%)	300(57.4%)	128(57.7%)	1909(40.3%)	1.57 (1.32–1.87)	0.000	2.34 (1.94–2.83)	0.000	2.44 (1.84–3.23)	0.000
MIG	425(12.8%)	95(14.9%)	91(17.6%)	43(20.0%)	654(14.0%)	1.18 (0.93–1.51)	0.172	1.35 (1.05–1.73)	0.020	1.61 (1.13–2.30)	0.008
OCD	31(0.9%)	5(0.8%)	10(1.9%)	12(5.5%)	58(1.2%)	0.84 (0.32–2.16)	0.709	2.06 (1.00–4.24)	0.049	6.09 (3.08–12.04)	0.000
ODD	35(1.1%)	16(2.5%)	12(2.3%)	17(7.8%)	80(1.7%)	2.42 (1.33–4.40)	0.004	2.36 (1.21–4.58)	0.011	8.31 (4.57–15.13)	0.000
PA	97(2.9%)	26(4.0%)	27(5.2%)	20(9.2%)	170(3.6%)	1.40 (0.90–2.17)	0.139	1.70 (1.10–2.64)	0.017	3.22 (1.95–5.34)	0.000
PTSD	67(2.0%)	28(4.4%)	28(5.4%)	27(12.4%)	150(3.2%)	2.21 (1.41–3.46)	0.001	2.60 (1.66–4.10)	0.000	6.61 (4.12–10.60)	0.000
SEA	121(3.6%)	25(3.9%)	42(8.1%)	18(8.2%)	206(4.4%)	1.07 (0.69–1.66)	0.773	2.24 (1.55–3.23)	0.000	2.29 (1.37–3.84)	0.002
SIM	440(13.2%)	98(15.3%)	97(18.7%)	41(18.7%)	676(14.3%)	1.18 (0.93–1.50)	0.180	1.41 (1.10–1.80)	0.006	1.44 (1.01–2.06)	0.046
SOC	288(8.6%)	60(9.3%)	97(18.7%)	42(19.2%)	487(10.3%)	1.09 (0.81–1.45)	0.584	2.35 (1.83–3.03)	0.000	2.45 (1.71–3.51)	0.000
SUDalcohol	277(8.3%)	88(13.7%)	64(12.3%)	54(24.4%)	483(10.2%)	1.85 (1.42–2.42)	0.000	1.89 (1.40–2.56)	0.000	4.52 (3.18–6.44)	0.000
SUDdrug	133(4.0%)	45(7.0%)	43(8.3%)	25(11.3%)	246(5.2%)	1.86 (1.31–2.64)	0.001	2.49 (1.73–3.57)	0.000	3.43 (2.17–5.43)	0.000
SUIC	83(2.5%)	45(7.0%)	62(11.9%)	42(18.9%)	232(4.9%)	2.98 (2.05–4.31)	0.000	4.98 (3.53–7.02)	0.000	8.84 (5.92–13.22)	0.000
Marital status	2055 (61.3%)	348(54.0%)	271(51.8%)	101(45.5%)	2775(58.5%)	0.74 (0.62–0.88)	0.001	0.72 (0.60–0.87)	0.001	0.54 (0.41–0.72)	0.000
Education	Mean(SD) 1.71(0.82)	Mean(SD) 1.55(0.75)	Mean(SD) 1.62(0.76)	Mean(SD) 1.51(0.76)	Mean(SD) 1.67(0.81)	p-value (KW) 0.000	p* 0.000	p-value (KW) 0.041	p* 0.247	p-value (KW) 0.000	p* 0.002
Income	Mean(SD) 3.90(1.52)	Mean(SD) 3.52(1.61)	Mean(SD) 3.57(1.56)	Mean(SD) 3.49(1.60)	Mean(SD) 3.79(1.55)	p-value (KW) 0.000	p* 0.000	p-value (KW) 0.000	p* 0.000	p-value (KW) 0.000	p* 0.001

Abbreviations: c1, the low adversities class; c2, the separation class; c3, the conflict-abuse class; c4, the high adversities class; ADHD, attention deficit hyperactivity disorder; AGO, agoraphobia; BP, bipolar disorder; CD, conduct disorder; DD, dysthymic disorder; GAD, generalized anxiety disorder; MDD, major depressive disorder; MIG, migraine; OCD, obsessive compulsive disorder; ODD, oppositional defiant disorder; PA, panic disorder; PTSD, post-traumatic stress disorder; SEA, separation anxiety; SIM, simple phobia; SOC, social phobia, SUDalcohol, substance (alcohol) use disorder; SUDdrug, substance (drug) use disorder; SUIC, suicidality (suicide attempts). OR: Odds Ratio; CI: confidence interval; SD: standard deviation; KW: Kruskal-Wallis Test; \*: significance values have been adjusted by the Bonferroni correction for multiple tests.

**4.2. Associations between CHAD patterns and the mental disorders/socioeconomic indicators**

Generally speaking, compared to c1 (low adversity class), the other three CHAD pattern classes showed worse mental health, especially the conflict-abuse class c3 and the high adversities class c4.

Noteworthy, c3 (conflict-abuse class) showed higher risks of mental disorders than c2 (separation class) in most of the cases. Given that c3 bears a comparable (slightly less) amount of CHAD to c2, this suggested that the CHAD configuration of being raised by conflictive / dysfunctional / abusive biological parents in c3 was associated with worse lifetime mental health than the being separated from the biological parents of c2. This was also systematically and graphically shown in the CA map, where most of the internalizing anxiety and mood disorders lay in the direction of or clustered around c3 (conflict-abuse class), instead of c2 or c4.

In all, compared to separation from parents, childhood adversity in terms of parental depression, domestic violence and abuse by parents seems to be even more related to internalizing anxiety and mood disorders, especially for the early-onset anxiety disorders. This was in line with the conclusion that domestic violence and childhood sexual abuse were the two most important risk factors for anxiety disorders [11]. It further supported the hypothesis that certain configurations of CHAD were critical for specific mental problems [27].

For some disorders, namely generalized anxiety disorder and dysthymic disorder, the conflict-abuse class c3 showed the highest risk of mental disorders of all four subgroups, including the high overall adversity class c4. This could probably be explained by other aspects of CHAD that had not been taken into account. For example, children in c3 who were raised by fighting parents may have suffered longer than those in c4 whose violent parents separated at an earlier age of the child. Alternatively, compared to those in c3, individuals in c4 may have

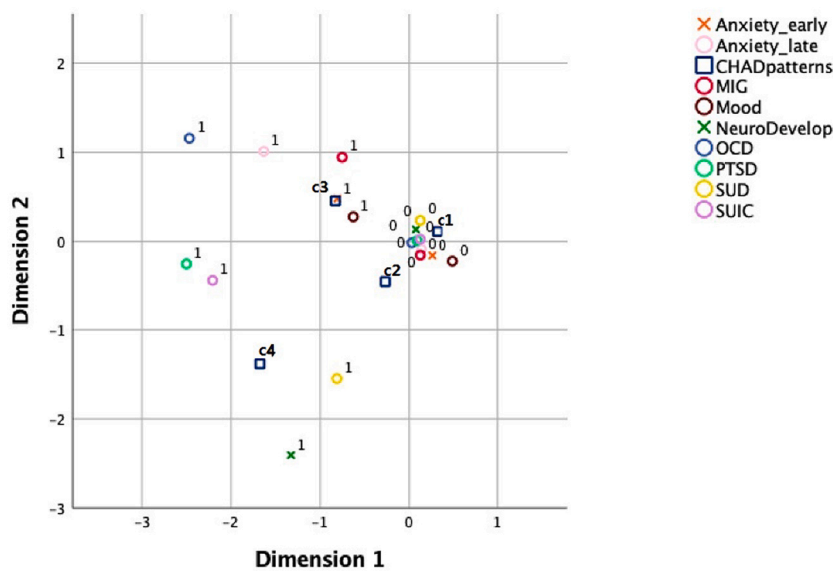


Fig. 2. Correspondence map of the CHAD patterns and associated mental disorders.

Note: For CHAD patterns, c1 stands for the low adversities class, c2 for the separation class, c3 for the conflict-abuse class and c4 for the high adversities class; For the common mental disorders, 0 stands for no diagnosis and 1 stands for diagnosis. Abbreviations: Anxiety\_early, early-onset anxiety disorders, i. e., separation anxiety, simple phobia and social phobia; Anxiety\_late, late-onset anxiety disorders, i. e., agoraphobia, generalized anxiety disorder and panic disorder; MIG, migraine; Mood, mood disorders, i. e., major depressive disorder, bipolar disorder (types I&II), dysthymic disorder; NeuroDevelop, neurodevelopmental disorders, i. e., ADHD, conduct disorder, and oppositional defiant disorder; OCD, obsessive compulsive disorder; PTSD, post-traumatic stress disorder; SUD, substance (alcohol/drug) use disorders (both abuse and dependence); SUIC, suicidality (suicide attempts).

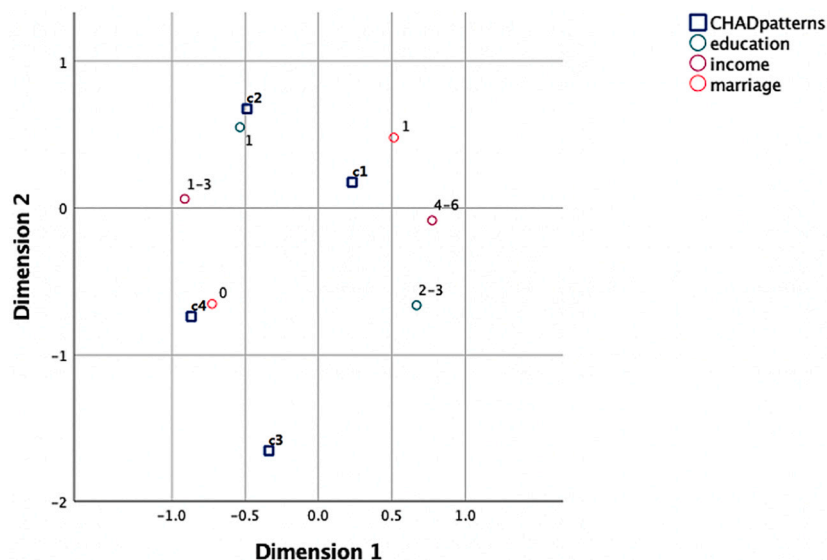


Fig. 3. Correspondence map of the CHAD patterns and associated socioeconomic indicators.<sup>11</sup>

learned additional coping skills that might lead to more resilience against the development of these two disorders, similar to a stress inoculation phenomenon [6,26,36]. However, more studies are warranted to confirm such hypotheses.

This was also shown in the CA map, where the internalizing anxiety or mood disorders were closely related with the CHAD pattern c3 (conflict-abuse class). In comparison, the externalizing disorders, namely neurodevelopmental disorders, suicidality and alcohol/drug use disorders were mostly in the direction of c2 (separation class) and c4 (high adversities class), the two separation related CHAD patterns. This was in line with findings from previous longitudinal studies on the effects of divorce over children’s mental development, which showed that compared to the children of intact families, children with divorced parents started earlier with alcohol/drug use [3,41] and parental divorce increased children’s externalizing behavioral problems [28].

As for adulthood marital status, income level and education achievement, compared to c1 (low adversity class), the other CHAD

pattern classes showed overall worse socioeconomic outcomes. Furthermore, the CA results suggested that in comparison to marital status which was more negatively associated with the CHAD pattern of high adversities (c4), the low education achievement was closely related to separation from the biological parents (c2), which was probably due to the lack of parental support. In contrast, the association between income and these two CHAD patterns was only moderate.

In summary, the current results showed that mental disorders were inconsistently related to the CHAD patterns, with only c3 (conflict-abuse class) and c4 (high adversities class) being strongly associated with most of the common mental disorders. Specifically, the internalizing anxiety or mood disorders were closely related with the CHAD pattern c3 (conflict-abuse class); the externalizing neurodevelopmental and substance use disorders were mostly related to the CHAD pattern c4 (high adversity class). Additionally, while the non-marital status was related to the CHAD pattern c4 (high adversities class), lower education achievement in adulthood was mostly associated with the CHAD pattern

of separation from parents (c2).

#### 4.3. Limitations

Due to the cross-sectional study design, no causal effects could be drawn from the current study. Accordingly, longitudinal studies are needed for further investigation of these CHAD patterns and their impact on lifetime mental health. In addition, the telescope effect and recall bias, which are common in retrospectively collected information, could render a certain bias in the data. The CHAD patterns were derived from a Swiss community sample, generalization into other contexts should be done with due caution. Last, the childhood event questions from the Schedule for Affective Disorders and Schizophrenia-Lifetime Version used for the measure of childhood adversities have not been validated. In addition, neglect as one important form of child maltreatment [33], was not assessed, along with the age sensitivity issue of CHAD exposure [45].

#### 5. Conclusion

Four CHAD patterns based on childhood abuse and family dysfunction were established in both men and women from a representative population sample. Heterogeneity was shown among the relationships between these CHAD patterns and various mental health and social outcomes. The conflict-abuse class c3 and the high adversities class c4 were most strongly associated with various mental disorders, especially c3 with internalizing anxiety or mood disorders such as early-onset anxiety disorders, generalized anxiety and dysthymic disorder. The separation class c2 was closely related to lower educational achievement. This concerned not only the configuration of CHAD within each pattern, but also the specific types of disorders/indicators involved, highlighting the need to assess the specific CHAD configurations for prevention and treatment of such disorders.

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#### Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

#### Declaration of competing interest

None.

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<sup>1</sup> Note: For CHAD patterns, c1 stands for the low adversities class, c2 for the separation class, c3 for the conflict-abuse class and c4 for the high adversities class; for education, 1 stands for the education level of basic, 2 for middle, 3 for university or above; for income, 1 stands for the annual income <30,000 CHF, 2 for between 30,000–49,999 CHF, 3 for between 50,000–69,999 CHF; 4 for between 70,000–80,999 CHF; 5 for between 90,000–110,000 CHF; 6 for >110,000 CHF.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.comppsy.2021.152282>.

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