

# The occurrence and co-occurrence of ACEs and their relationship to mental health in the United States and Ireland

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## ABSTRACT

**Background:** Adverse childhood experiences (ACEs) have various deleterious effects on mental health but few studies have been conducted in Ireland.

**Objective:** The primary objective was to determine if there were significant differences in occurrences of ACEs in U.S. and Irish adults. We also sought to determine if there were unique associations between individual and multiple ACE events and mental health.

**Participants and setting:** Preexisting nationally representative adult samples from the U.S. (n = 1893) and Ireland (n = 1020) were utilized for analysis.

**Method:** To determine if there were significant differences in the occurrence of specific ACE events and the mean number of ACEs experienced by U.S. and Irish adults, chi-square difference tests and an independent samples *t*-test were used, respectively. Binary logistic regression was used to examine the unique associations between ACE events and major depressive disorder (MDD), generalized anxiety disorder (GAD), posttraumatic stress disorder (PTSD), and Complex PTSD (CPTSD). Nationality, sex, age, and educational level were included as covariates and adjusted odds ratios are reported.

**Results:** Irish respondents had a higher rate of ACEs, were more likely to experience specific ACEs, and to meet diagnostic requirements for MDD, GAD, and CPTSD than U.S. respondents. Emotional neglect was more strongly related to mental health than all other ACEs, and there was an exceptionally strong dose-response association between ACEs and CPTSD.

**Conclusions:** ACEs seem to be more common in Ireland than the U.S., and efforts to minimize exposure to ACEs through public policies may lead to beneficial mental health effects.

## 1. Introduction

The topic of childhood adversities and their deleterious effects on adult health and wellbeing has garnered a great deal of interest over the past two decades. The seminal Adverse Childhood Experiences (ACE) Study, conducted in the United States of America (U.S.) by the Kaiser Permanente health care organization and the Centers for Disease Control, revealed dose-response relationships between ACEs and multiple health risk factors including leading causes of death such as heart disease, chronic lung disease and cancer (Felitti et al., 1998). In general, there is a consensus that ACEs consist of the three categories included in the original study: abuse (verbal,

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physical, and sexual), neglect (emotional and physical), and household dysfunction (witnessed domestic violence, parents separated or divorced, an alcoholic household member, a mentally ill/attempted suicide household member, and a household member in prison). Since the original ACE study, there has been an abundance of research regarding ACEs in the U.S., and a growing body internationally (Bellis et al., 2014; Riedl et al., 2020; Subramaniam et al., 2020). Numerous studies with representative samples have been conducted in the U.S. to estimate the occurrence of ACEs in the population. A recent large-scale study ( $N = 214,157$ ) found that 62% of the U.S. adult population had experienced at least one ACE event (Merrick et al., 2018).

There are limited data available regarding the occurrence of ACEs in the general population of the Republic of Ireland. Using data from the Growing up in Ireland longitudinal cohort study of Irish youths between nine and thirteen years of age, Gardner et al. (2019) reported that 73% had experienced one or more ACE. However, these data are limited by virtue of the fact that ACEs were measured using 14 items, and of which, only four were from the original ACE questionnaire. Items regarding abuse and neglect were omitted, and items related to bereavement, illness, and moving were included. Data from the Irish Longitudinal Study on Ageing (TILDA), a nationally representative longitudinal study of adults aged 50 and older, found that 23.7% had experienced an ACE (Ward et al., 2020). Consequently, it is currently unknown what proportion of the general adult population of Ireland have experienced one or more ACEs in their lifetime. There are some cultural events and factors that suggest that ACEs may be relatively high in Ireland. For example, based on sales data, Ireland was in the top ten countries found to have the highest consumption rates of alcohol (over 11 l per person, per year; OECD, 2019). There have also been widely documented clerical and institutional abuses that occurred over decades (Carr et al., 2010). Moreover, evidence suggests that mental disorders in Ireland may be relatively high, as reported in a study spanning 26 European countries (OECD, 2017). Ireland was found to have a 12.1% self-reported depression rate which was the fourth highest of the countries included in the study, and considerably higher than the European average of 7.9%.

Overexposure to stressful life events such as ACEs will likely have formational impacts on the developing brain leading to maladaptive behaviors and symptoms of trauma related mental illness such as depression, anxiety, and posttraumatic stress (Pelcovitz et al., 2000). Numerous studies have connected traumatic stress to symptoms of depression and anxiety (Anda et al., 2002; Dube et al., 2001; Friedman et al., 2002). Anda et al. (2006) found that those who experience four or more ACEs have a 49% increased risk of developing depressive symptoms and a 19% increased risk of developing symptoms of anxiety. Previous research has also shown that emotional abuse is most strongly related to depression, and sexual or physical abuse is most strongly related to anxiety (Friedman et al., 2002; Mandelli et al., 2015). According to Kessler et al. (2010), ACEs account for 29.8% of mental health disorders across the world.

Few studies have compared the occurrence and mental health correlates of ACEs across different nations/cultures. To better understand the occurrences of ACEs, we set out in this study to compare the rates of ACEs and their associations with common mental health problems using nationally representative data from the U.S. and Ireland. The U.S. and Ireland are similar in that they share commonalities such as language, government type (i.e., democratic/republic), and economic relationships (e.g., international trade, foreign investments, U.S. multinational companies), while also being culturally and geographically distinct from one another (e.g., size/population, diversity, and history). Several study objectives were formulated. First, we sought to determine if there were significant differences in the occurrence of individual ACE events, and overall levels of ACE exposure, in U.S. and Irish adults. Second, we examined if there were unique associations between each ACE event and different mental health variables including meeting diagnostic criteria for major depressive disorder (MDD), generalized anxiety disorder (GAD), posttraumatic stress disorder (PTSD), and complex PTSD (CPTSD). Finally, we assessed if there was a dose-response association between the number of ACEs experienced and each mental health disorder.

## 2. Method

### 2.1. Participants and procedures

#### 2.1.1. U.S. sample

The U.S. data were collected as part of a project to assess the construct validity of PTSD and CPTSD for the 11th version of the International Classification of Diseases (*ICD-11*) in March 2017 (see Cloitre et al., 2019). This nationally representative sample of non-institutionalized adults was collected using an existing online research panel through a market research company called Growth from Knowledge (GfK). The panel was randomly recruited through probability-based sampling and representative of the entire U.S. population. Of the 3953 people contacted, 1893 met the inclusion criteria which included those between 18 and 70 years of age who had experienced at least one traumatic event in their lifetime. Due to an increased likelihood of experiencing traumatic events and higher rates of trauma related diagnoses, women and racial minority groups were intentionally oversampled, both at a 2:1 ratio. The data were then weighted to adjust for oversampling to establish a sample representative of the entire U.S. adult population. Ethical approval was provided by the Research Ethics Committee at the National College of Ireland. Participants were compensated by GfK for their participation in the panel. The median completion time was 18 min and informed consent was obtained before survey completion.

#### 2.1.2. Irish sample

A nationally representative sample of non-institutionalized Irish adults aged 18 years and older was collected in February 2019 by a survey research company called Qualtrics. Quota sampling methods were used to construct a non-probability-based sample that was representative of the general adult population in terms of sex, age, and geographical distribution (Hyland et al., 2021). These three sample characteristics match known population parameters as per the 2016 Irish census data (Central Statistics Office, 2020). The number of people contacted was not gathered therefore it was impossible to determine a participation rate; however, the final sample included 1020 participants. Those who chose to participate were provided detailed information about the study prior to their

participation and ethical approval was provided by the Social Research Ethics Committee at Maynooth University, Ireland. Participants were remunerated for their time by Qualtrics. The median completion time was 22 min. Sociodemographic details for the U.S. and Irish samples are presented in Table 1. Sociodemographic details that were included in the samples but were not used for analysis can be found in Supplementary Table 1.

### 2.1.3. Measures

**2.1.3.1. ACEs.** The U.S. and Irish samples completed the Adverse Childhood Experiences questionnaire (ACE-Q; Felitti et al., 1998) which measures exposure to ten events occurring before the age of 18 (see Fig. 1 for a description of each event). All items were answered on a 'Yes' (1) or 'No' (0) basis. The measure is widely used and multiple studies with adult samples have demonstrated that the ACE-Q produces reliable and valid scale scores (Dube et al., 2004; Ford et al., 2014; Murphy et al., 2014; Wingenfeld et al., 2011).

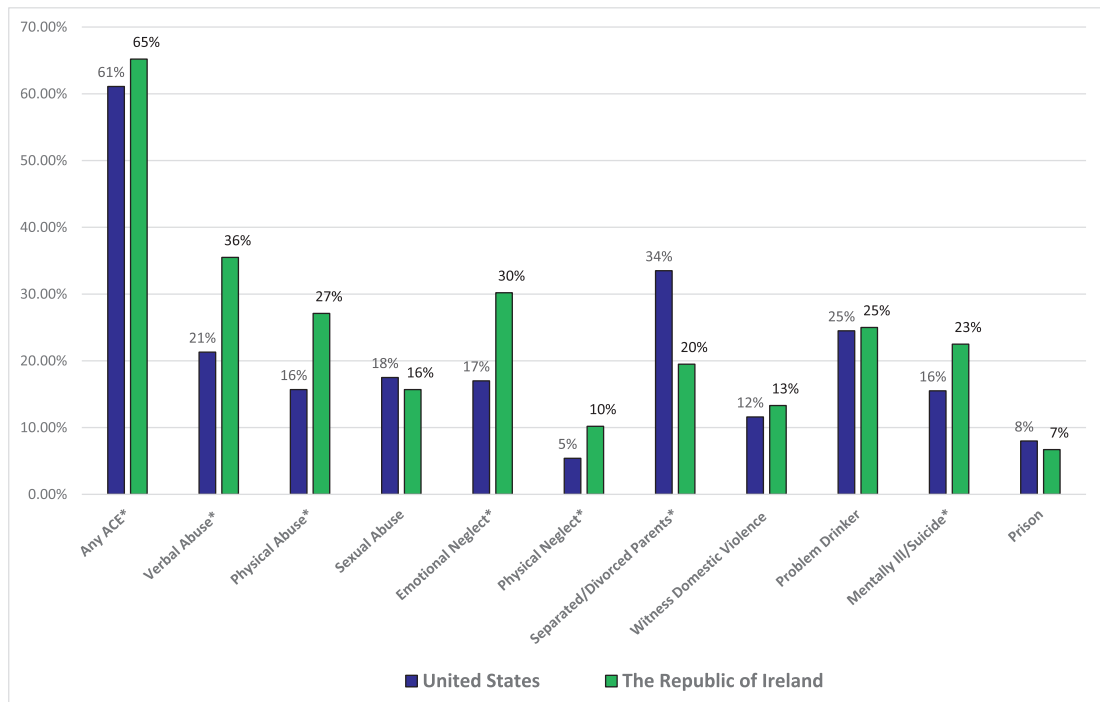
**2.1.3.2. MDD.** The Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001) was used to measure MDD in the Irish sample, while the eight-item version of the PHQ (Kroenke et al., 2009) was used in the U.S. sample. The PHQ-9 differs from the PHQ-8 in that it includes one item measuring suicidality/self-harm. To ensure consistency across the two samples, we removed item 9 from the Irish sample for all analyses. Respondents indicated how often they have been bothered by each symptom over the last two weeks using a four-point Likert scale ranging from 0 ('Not at all') to 3 ('Nearly every day'). Scores range from 0 to 24, and a score of 10 or above is indicative of a probable MDD diagnosis (Kroenke et al., 2001, 2009). The PHQ-8 has demonstrated excellent psychometric properties (Manea et al., 2015; Wu et al., 2020), and the internal reliability (Cronbach's alpha) of the scale scores were excellent in the Irish ( $\alpha = 0.90$ ) and U.S. ( $\alpha = 0.93$ ) samples.

**2.1.3.3. GAD.** The Generalized Anxiety Disorder 7-item Scale (GAD-7; Spitzer et al., 2006) was used to measure GAD symptoms in both samples. Respondents indicated how often they have been bothered by each symptom over the last two weeks using a four-point Likert scale ranging from 0 ('Not at all') to 3 ('Nearly every day'). Scores range from 0 to 21 with higher scores reflecting higher symptomology. A score of 10 or above is indicative of a probable GAD diagnosis (Spitzer et al., 2006). The psychometric properties of the GAD-7 have been shown to be excellent in prior adult samples (Kertz et al., 2013), and the internal reliability of the scale scores were excellent in the Irish ( $\alpha = 0.91$ ) and U.S. ( $\alpha = 0.94$ ) samples.

**2.1.3.4. PTSD and CPTSD.** The International Trauma Questionnaire (ITQ; Cloitre et al., 2018) was used to measure symptoms of PTSD and CPTSD in the U.S. and Irish samples. The ITQ includes six items measuring PTSD symptoms across the three symptom clusters of Re-experiencing in the here and now, Avoidance, and Sense of Current Threat, and six items measuring Disturbances in Self-Organization (DSO) symptoms across the three clusters of Affective Dysregulation, Negative Self-Concept, and Disturbed Relationships. All items are answered in relation to the participant's most distressing traumatic life event. Respondents indicate how much they have been bothered by each PTSD symptom during the past month and how they typically feel, think about oneself, and relate to others for each DSO symptom. In addition, there are three items measuring functional impairment for both sets of symptoms. Functional impairments are in the areas of social, occupational/educational, and other important areas of life. A five-point Likert scale ranging from 0 (Not at all) to 4 (Extremely) is used for each item and when a response is  $\geq 2$  (Moderately) on the Likert scale, the symptom is considered to be present (Cloitre et al., 2018). The psychometric properties of the ITQ scores have been supported in general population samples and the internal reliability scale scores in the U.S. sample for PTSD ( $\alpha = 0.89$ ), DSO ( $\alpha = 0.89$ ), and total ( $\alpha = 0.92$ ) were

**Table 1**  
Sociodemographic included in analysis.

	Ireland	U.S.
	n = 1020	n = 1839
	% (n)	% (n)
Sex		
Male	49.0 (500)	48.0 (883)
Female	51.0 (520)	52.0 (956)
Age in years		
18–24	12.3 (125)	10.0 (184)
25–34	20.2 (206)	20.7 (382)
35–44	23.5 (240)	19.0 (350)
45–54	19.1 (195)	18.5 (339)
55–64	14.1 (144)	21.6 (398)
65+	10.8 (110)	10.2 (187)
Age	M = 43.10, SD = 15.12	M = 44.55, SD = 14.89
Highest educational attainment		
Did not complete secondary school	7.1 (72)	9.1 (168)
Completed secondary school	39.2 (400)	48.4 (891)
Completed an undergraduate university degree	36.9 (376)	30.3 (558)
Completed a postgraduate university degree	16.9 (172)	12.1 (223)



**Fig. 1.** Frequencies of ACEs based on nationality.  
Note. \* $p < .001$ .

excellent as were the scale scores for the Irish sample for PTSD ( $\alpha = 0.91$ ), DSO ( $\alpha = 0.93$ ), and total ( $\alpha = 0.95$ ). Exposure to a traumatic event, the presence of at least one symptom from each PTSD cluster, and at least one indicator of functional impairment associated with these symptoms are required for a PTSD diagnosis. At least one symptom from each DSO cluster, at least one indicator of functional impairment associated with these symptoms, and all of the PTSD criteria must be present for a CPTSD diagnosis. According to the ICD-11 diagnostic rules, an individual cannot receive a diagnosis of both PTSD and CPTSD therefore if a person satisfies the criteria for CPTSD they receive that diagnosis over a PTSD diagnosis.

## 2.2. Data analysis procedures

Chi-square ( $\chi^2$ ) difference tests were used to determine if there were significant differences in the occurrence of any ACE exposure and individual ACE events in U.S. and Irish adults. An independent samples  $t$ -test was used to determine if there was a significant difference in the mean number of ACEs experienced by U.S. and Irish adults. The magnitude of the mean differences was assessed using Cohen's  $d$ , with values  $< 0.5$  indicating a small effect, values between 0.5 and 0.8 indicating a medium effect, and values  $> 0.8$  indicating a large effect.

To examine the unique associations between each ACE event and each mental health diagnosis (viz., MDD, GAD, PTSD, CPTSD), and to examine if there was a dose-response relationship between number of ACEs (i.e., one, two, three, and four or more) and meeting criteria for each mental health disorder, we used binary logistic regression (BLR) analyses. The U.S. and Irish samples were combined for these analyses, and nationality (0 = U.S., 1 = Irish), sex (0 = males, 1 = females), age, and educational level (0 = did not finish high/secondary school, 1 = finished high/secondary school, 2 = completed an undergraduate university degree, and 3 = completed a postgraduate university degree) were included as covariates. To evaluate the dose-response relationships, ACE scores were recoded into a categorical variable (0 = no ACE event, 1 = one ACE, 2 = two ACEs, 3 = three ACEs, 4 = four or more ACEs). Missing data ranged from 2.6% to 5.2% and handled by the default listwise deletion option in SPSS for BLR. Adjusted odds ratios (AOR) are reported.

## 3. Results

### 3.1. Comparing occurrences

Frequencies of ACEs based on nationality are presented in Fig. 1. Several significant differences between Irish and U.S. respondents were found. More than half of the Irish (65.2%) and U.S. (61.1%) adults had experienced at least one ACE event, and Irish respondents were significantly more likely to have experienced at least one ACE than U.S. respondents ( $\chi^2(1) = 4.56, p = .033, OR = 1.19$  [95% CI = 1.01, 1.40]). Irish respondents were also significantly more likely than U.S. respondents to have experienced verbal abuse (35.5% vs

21.3%,  $\chi^2(1) = 68.11, p < .001, OR = 2.04$  [95% CI = 1.71, 2.41]), physical abuse (27.1% vs 15.7%,  $\chi^2(1) = 62.93, p < .001, OR = 2.10$  [95% CI = 1.74, 2.53]), emotional neglect (30.2% vs 17.0%,  $\chi^2(1) = 66.63, p < .001, OR = 2.1$  [95% CI = 1.76, 2.52]), physical neglect (10.2% vs 5.4%,  $\chi^2(1) = 23.35, p < .001, OR = 2.01$  [95% CI = 1.51, 2.68]), and mentally ill/suicidal household member (22.5% vs 15.5%,  $\chi^2(1) = 21.57, p < .001, OR = 1.58$  [95% CI = 1.30, 1.92]). U.S. respondents were significantly more likely than Irish respondents to have separated/divorced parents (33.5% vs 19.5%,  $\chi^2(1) = 62.62, p < .001, OR = 0.48$  [95% CI = 0.40, 0.58]).

Additionally, a statistically significant difference was found between the mean number of ACEs in the Irish ( $M = 2.08, SD = 2.32$ ) and U.S. ( $M = 1.70, SD = 2.10$ ) samples, however, the effect size was small ( $t(2804) = -4.36, p < .001, d = 0.17$ ).

### 3.2. Associations between ACEs and mental health diagnoses

The AORs for the associations between individual ACEs, along with sociodemographic factors, and meeting diagnostic requirements for MDD, GAD, PTSD, and CPTSD are reported in full in Table 2.

The BLR models for MDD ( $\chi^2(16, 2711) = 562.94, p < .001$ ), GAD ( $\chi^2(16, 2716) = 464.02, p < .001$ ), PTSD ( $\chi^2(16, 2784) = 115.78, p < .001$ ), and CPTSD ( $\chi^2(16, 2784) = 231.60, p < .001$ ) were all statistically significant. Regarding associations between individual ACEs and meeting diagnostic requirements, irrespective of sociodemographic factors, four events were significantly associated with MDD: verbal abuse (AOR = 1.90,  $p < .001$ ), sexual abuse (AOR = 2.10,  $p < .001$ ), emotional neglect (AOR = 2.49,  $p < .001$ ), and a mentally ill/attempted suicide household member (AOR = 2.14,  $p < .001$ ). The same ACE events were found to be significantly associated with GAD: verbal abuse (AOR = 1.87,  $p < .001$ ), sexual abuse (AOR = 1.98,  $p < .001$ ), emotional neglect (AOR = 2.24,  $p < .001$ ), and a mentally ill/attempted suicide household member (AOR = 1.90,  $p < .001$ ), with the addition of witnessed domestic violence (AOR = 1.49,  $p = .028$ ). Significant associations were found between PTSD and three ACE events: emotional neglect (AOR = 2.03,  $p = .007$ ), problem drinker in household (AOR = 1.71,  $p = .028$ ), and household member in prison (AOR = 1.94,  $p = .022$ ). Finally, five ACE events were significantly associated with CPTSD: sexual abuse (AOR = 3.06,  $p < .001$ ), emotional neglect (AOR = 1.69,  $p = .021$ ), witnessed domestic violence (AOR = 1.69,  $p = .030$ ), problem drinker in household (AOR = 1.91,  $p = .002$ ), and a mentally ill/attempted suicide household member (AOR = 1.71,  $p = .010$ ). A graphical representation of these results can be found in Fig. 2.

Other notable results from these analyses were that Irish respondents were significantly more likely than U.S. respondents to meet diagnostic requirements for MDD, GAD, and CPTSD, irrespective of all other factors in the model. Females were significantly more likely to meet diagnostic criteria MDD, GAD, and PTSD than males. Younger age was significantly associated with meeting requirements for all four diagnoses. And finally, higher educational attainment was associated with a reduced risk of meeting diagnostic requirements for MDD and GAD (see Table 2 for full details).

**Table 2**  
Binary logistic regression results for each mental health disorder.

	MDD		GAD		PTSD		CPTSD	
	AOR	95% CI	AOR	95% CI	AOR	95% CI	AOR	95% CI
Nationality								
U.S.	0 <sup>a</sup>							
Ireland	1.98***	1.58–2.49	2.09***	1.63–2.68	1.09	0.72–1.67	1.61*	1.10–2.36
Sex								
Male	0 <sup>a</sup>							
Female	1.47***	1.18–1.84	1.81***	1.41–2.33	1.76*	1.14–2.71	1.02	0.69–1.50
Age	0.97***	0.97–0.98	0.98***	0.96–0.98	0.96***	0.95–0.98	0.98***	0.96–0.99
Education								
Not secondary	0 <sup>a</sup>							
Secondary school	0.66*	0.46–0.96	0.56**	0.38–0.82	1.41	0.65–3.07	1.03	0.54–1.97
Undergraduate	0.50***	0.34–0.74	0.43***	0.28–0.64	1.06	0.47–2.39	0.94	0.48–1.83
Postgraduate	0.38***	0.24–0.60	0.30***	0.18–0.50	2.17	0.093–5.07	0.94	0.44–2.03
ACE events								
Verbal abuse	1.88***	1.14–2.56	1.87***	1.35–2.59	1.24	0.70–2.17	1.54	0.93–2.55
Physical abuse	0.89	0.65–1.21	0.74	0.53–1.03	1.04	0.60–1.78	1.46	0.92–2.33
Sexual abuse	1.97***	1.51–2.58	1.98***	1.45–2.63	1.40	0.87–2.23	3.06***	2.06–4.54
Emotional neglect	2.48***	1.91–3.23	2.24***	1.68–2.99	2.03**	1.22–3.37	1.69*	1.08–2.64
Physical neglect	1.19	0.82–1.74	0.97	0.65–1.45	1.73	0.96–3.10	1.13	0.69–1.87
Separation/divorce	0.90	0.70–1.16	1.01	0.77–1.33	0.98	0.62–1.53	0.68	0.45–1.04
Witness DV	0.98	0.69–1.37	1.49*	1.05–2.13	0.96	0.54–1.73	1.69*	1.05–2.72
Problem drinker	1.29	1.00–1.67	1.10	0.83–1.47	1.71*	1.06–2.75	1.91**	1.26–2.89
Mentally ill/AS	2.11***	1.64–2.73	1.90***	1.44–2.51	0.73	0.44–1.21	1.71*	1.14–2.56
Prison	1.17	0.80–1.71	1.10	0.74–1.63	1.94*	1.10–3.43	0.94	0.54–1.63

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

<sup>a</sup> This parameter is set to zero because it is redundant.

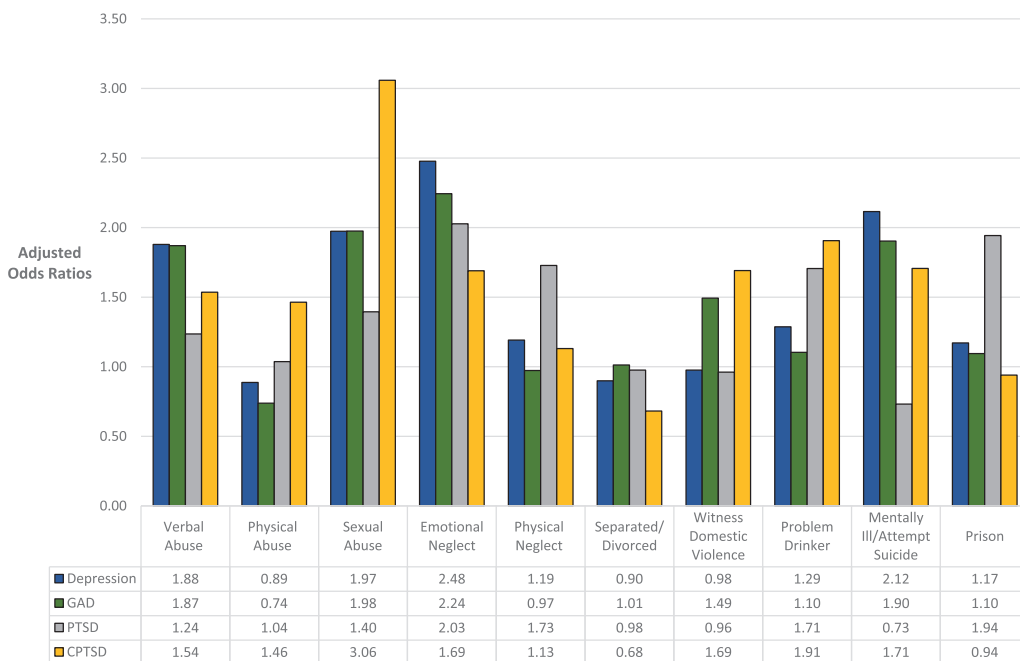


Fig. 2. Associations between each ACE event and mental health outcomes when controlling for nationality, age, sex, and highest level of education.

3.3. Dose-response associations

The BLR models evaluating the dose-response associations between number of ACEs (one event, two events, three events, and four or more events) and meeting diagnostic criteria, were statistically significant across the four diagnoses: MDD ( $\chi^2(10, 2711) = 485.62, p < .001$ ), GAD ( $\chi^2(10, 2302) = 400.70, p < .001$ ), PTSD ( $\chi^2(10, 2784) = 103.12, p < .001$ ), and CPTSD ( $\chi^2(10, 2784) = 174.08, p < .001$ ). There was evidence of a dose-response association for all four diagnoses with the strength of the association increasing at each level of ACE exposure. Statistically significant associations were found between: MDD and one (AOR = 2.35,  $p < .001$ ), two (AOR = 3.50,  $p < .001$ ), three (AOR = 5.87,  $p < .001$ ), and  $\geq$ four (AOR = 9.25,  $p < .001$ ) ACE events; GAD and one (AOR = 2.11,  $p < .001$ ), two

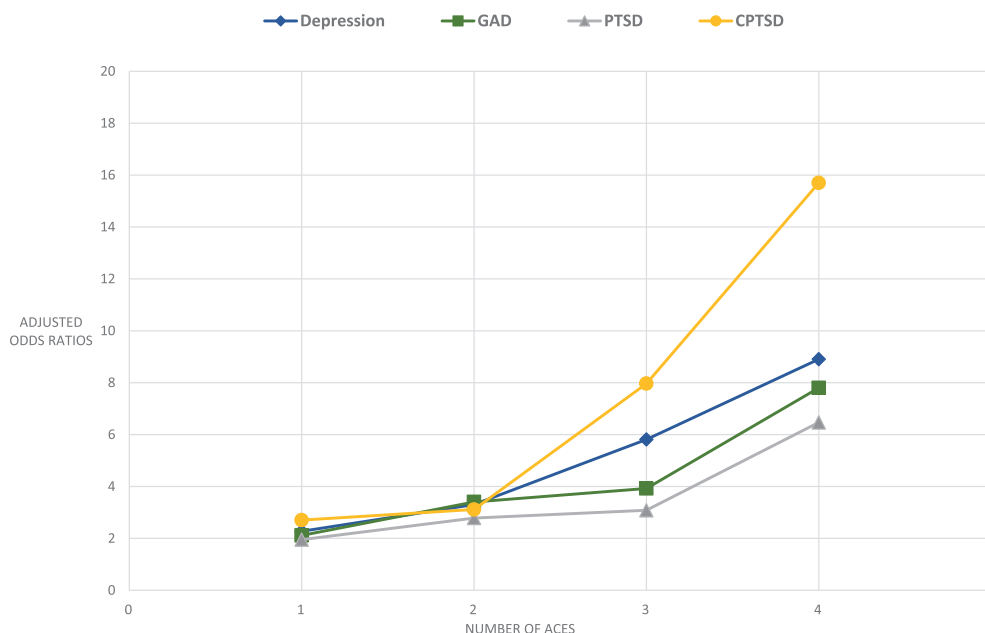


Fig. 3. Dose response associations between number of ACEs and mental health outcomes.



(AOR = 3.41,  $p < .001$ ), three (AOR = 3.93,  $p < .001$ ), and  $\geq$ four (AOR = 7.80  $p < .001$ ) ACE events; CPTSD and one (AOR = 2.70,  $p = .011$ ), two (AOR = 3.11,  $p = .007$ ), three (AOR = 7.97,  $p < .001$ ), and  $\geq$ four (AOR = 15.70  $p < .001$ ) ACE events. The dose-response associations between ACE levels and PTSD were significant with the exception of one ACE event (AOR = 1.95,  $p = .064$ ). Statistically significant dose-response associations were found between PTSD and two (AOR = 2.78,  $p = .005$ ), three (AOR = 3.08,  $p < .004$ ), and  $\geq$ four (AOR = 6.47  $p < .001$ ) ACE events. Graphical representation of these results can be found in Fig. 3.

#### 4. Discussion

The primary aim of this study was to better understand the occurrence of ACEs and their association with common mental health problems in the U.S. and Ireland. We found that Irish adults were significantly more likely than U.S. adults to experience an ACE and had a higher mean number of ACEs. We also found statistically significant associations between meeting criteria for each diagnosis and various individual ACEs. Emotional neglect was the only ACE event significantly associated with all four diagnoses and those who experienced emotional neglect were approximately two- to two-and-a-half times more likely to meet requirements for each disorder. Additionally, living with someone with a mental illness or attempted suicide, and sexual abuse, were significantly associated with MDD, GAD, and CPTSD. The ACEs that were significantly associated with PTSD were emotional neglect (shared among all four diagnoses), having a problem drinker in the household (shared only with CPTSD), and having a household member in prison. Finally, we found a statistically significant dose-response relationship for all four diagnoses however CPTSD had a much greater likelihood of occurrence as the number of ACE events increased.

To our knowledge, this study was not only the first to directly compare ACEs in the U.S. and Ireland but it is also the first study to examine ACEs from a nationally representative adult sample from Ireland. We found that 61% of U.S. adults had experienced at least one ACE event which is in line with another large-scale study conducted in the U.S. that reported that 62% of the U.S. adult population had experienced at least one ACE event (Merrick et al., 2018). Additionally, we found that 65% of Irish adults had experienced at least one ACE. This evidence suggests that the rate of ACEs in Ireland is likely to be much higher than the 24% of respondents who had experienced at least one ACE reported from the TILDA study which used a sample of participants aged 50 and older (Ward et al., 2020). This evidence also suggests that the rate of ACEs is much lower than the 73% reported using the Growing up in Ireland study which had a sample of youths between nine and thirteen years of age and measured ACEs using a questionnaire that contained 14 items, four of which were from the original ACE questionnaire (Gardner et al., 2019). Additionally, Irish respondents were just over two times more likely than U.S. respondents to have experienced four of the five abuse and neglect items (viz., verbal abuse, physical abuse, emotional neglect, and physical neglect) and having a household member who had a mental illness or attempted suicide. Respondents from the U.S. were significantly more likely to have experienced parental separation or divorce. This latter finding may be due to a cultural difference between Ireland and the U.S. which is that divorce was only legalised in Ireland in 1996 while it has been legal in the U.S. since as far back as the 19th century.

Another unique aspect of this study is that we isolated the predictor variables to evaluate outcomes regardless of sociodemographic factors as well as other ACEs. In doing so, we found additional information regarding differences between adults in the U.S. and Ireland. We found that Irish respondents were approximately two times more likely than U.S. respondents to meet diagnostic requirements for MDD, GAD, and CPTSD, irrespective of all other factors. This is somewhat consistent with the Organization for Economic Co-operation and Development (OECD, 2017) report which reported that Ireland was found to have a 12.1% depression rate while Cao et al. (2020), found that the rate in the U.S. was 8%. However, the central purpose of isolating predictor variables was to analyse the associations between the individual ACE events and diagnostic outcomes when removing the possible influence of other factors.

Our analysis of ACEs and diagnostic outcomes revealed some particularly notable findings. The significant associations between emotional neglect and all four diagnoses highlight the toxic nature of emotional neglect. Verbal abuse and emotional neglect were the most prevalent ACEs in the Irish sample which is similar to the findings from a sample of Irish university students (Corcoran & McNulty, 2018). However, verbal abuse was not significantly associated with PTSD or CPTSD. Pietrek et al. (2013) found that emotional neglect had greater associations with MDD as well as schizophrenia, and borderline personality disorder than physical punishment, sexual abuse, and general trauma. Additionally, Green et al. (2010) found that those who experiences emotional neglect were nearly two times more likely to abuse substances which was second only to those whose parents suffered from substance abuse. Emotional neglect has been found to cause low oxytocin levels and is associated with insecure attachment which, among other issues, impacts one's ability to form relationships (Müller et al., 2019). Survival insecurity due to a lack of caregiver attachment, resulting in social dysfunction, may explain the associations between emotional neglect and all four diagnoses. It is important to raise awareness of these associations in adults that are in positions to observe signs of emotional neglect in a child (e.g., teachers, neighbours) which may promote the reporting of cases to the proper authorities.

Other notable findings relate to PTSD and CPTSD. In the recent revision of the ICD-11, the PTSD diagnosis was updated and CPTSD was introduced. This study is the first to evaluate dose-response relationships between ACEs and the ICD-11 versions of PTSD and CPTSD. The substantially increased likelihood of meeting criteria for CPTSD (nearly 16 times) when experiencing four or more ACE events is particularly noteworthy. Additionally, we found that the strongest unique association for all predictors and all outcomes was between CPTSD and sexual abuse in which respondents were just over three times more likely to meet diagnostic requirements for CPTSD. This association is consistent with other empirical findings (e.g., Hyland et al., 2017).

Several limitations should be considered regarding these findings. First, the survey was conducted using self-report measures which may limit the precision of the responses and therefore replication with clinician-administered interviews would be beneficial. Second, the surveys were collected at separate times and were not designed for the specific purpose of cross-country comparisons meaning that

only a small number of covariates could be included as they were common across both surveys. Third, additional potentially traumatic events that may have occurred outside of the home such as bullying or community violence were not included in this study and may have played a role in the mental health variables. Future research should include additional adversities that may occur during childhood.

In summation, the main findings from this study were: (1) Irish respondents had a slightly higher rate of ACEs than U.S. respondents, and were more likely to experience numerous detrimental ACEs, and were more likely to meet diagnostic requirements for MDD, GAD, and CPTSD; (2) CPTSD had strong associations with five ACEs and had an exceptionally strong dose-response relationship when experiencing four or more ACE events; (3) while it may be assumed to be a less acute ACE than abuse items, emotional neglect had a stronger association with mental health than all other ACEs. While the complete eradication of ACE events may not be feasible, efforts to minimize exposure to ACEs through public policies will likely have a positive effect on population mental health.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.chiabu.2022.105681>.

## Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committee on human experimentation with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained, and ethical approval was provided by an ethics committee.

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## Data availability statement

The data are available upon request to the corresponding author.

## Declaration of competing interest

Marylène Cloitre participated as a member of the World Health Organization Working Group on the Classification of Disorders Specifically Associated with Stress, reporting to the International Advisory Group for the Revision of ICD-10 Mental and Behavioural Disorders. However, the views expressed reflect the opinions of the authors and not necessarily the Working Group or Advisory Group and the content of this article does not represent WHO policy.

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