Adverse childhood experiences, childhood relationships and associated substance use and mental health in young Europeans

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Background: Adverse childhood experiences (ACEs) can increase risks of health-harming behaviours and poor health throughout life. While increases in risk may be affected by resilience resources such as supportive childhood relationships, to date few studies have explored these effects. **Methods:** We combined data from cross-sectional ACE studies among young adults ($n = 14\,661$) in educational institutions in 10 European countries. Nine ACE types, childhood relationships and six health outcomes (early alcohol initiation, problem alcohol use, smoking, drug use, therapy, suicide attempt) were explored. Multivariate modelling estimated relationships between ACE counts, supportive childhood relationships and health outcomes. **Results:** Almost half (46.2%) of participants reported ≥1 ACE and 5.6% reported ≥4 ACEs. Risks of all outcomes increased with ACE count. In individuals with ≥4 ACEs (vs. 0 ACEs), adjusted odds ratios ranged from 2.01 (95% CIs: 1.70–2.38) for smoking to 17.68 (95% CIs: 12.93–24.17) for suicide attempt. Supportive childhood relationships were independently associated with moderating risks of smoking, problem alcohol use, therapy and suicide attempt. In those with ≥4 ACEs, adjusted proportions reporting suicide attempt reduced from 23% with low supportive childhood relationships to 13% with higher support. Equivalent reductions were 25% to 20% for therapy, 23% to 17% for problem drinking and 34% to 32% for smoking. **Conclusions:** ACEs are strongly associated with substance use and mental illness. Harmful relationships are moderated by resilience factors such as supportive childhood relationships. Whilst ACEs continue to affect many children, better prevention measures and interventions that enhance resilience to the life-long impacts of toxic childhood stress are required.

Introduction

The experiences that children have whilst growing up lay the foundations for their health and well-being throughout life. Providing children with the best start in life is a fundamental aspect of European health policy.[1] However, over 55 million children in the European Region are estimated to be affected by child maltreatment and millions more will suffer other stressful experiences, such as witnessing domestic violence or living in a household affected by substance misuse or mental illness.[2] The last decade has seen growing awareness of the damage that such adverse childhood experiences (ACEs) can have on child development, adult health and life opportunities.[3–5] In particular, advances in neurodevelopmental and epigenetic research have identified how chronic early life stress imposed by ACEs can generate lasting changes in children's developing neurological and physiological systems. In turn, these can embed susceptibility to health-damaging behaviours, mental illness and chronic disease.[6,7] Corroboratively, research shows strong, cumulative relationships between ACEs and a wide range of health-related outcomes, with such effects being identified across an expanding range of geographies and populations.[4]

Increased understanding of the impacts of ACEs is driving multi-sector action to develop effective responses.[8,9] Thus, work is focussing on prevention to reduce the risk of child maltreatment and other ACEs[10] and, increasingly, the development of trauma-informed services to better support those affected by ACEs.[11,12] There is also growing awareness of the role of resilience in protecting individuals that suffer ACEs from developing their harmful effects. Resilience can be thought of as the ability to overcome hardship, and the concept helps explain why some people manage to thrive despite significant childhood adversity.[13,14] Thus, the relationship between ACEs and poor life-course health is not deterministic and building children's resilience can help them overcome adversity. Key factors that contribute to the development of resilience in childhood include interpersonal skills, a sense of control over personal circumstances and strong links to cultural traditions. However, the strongest building block of resilience is considered to be the availability of stable, caring relationships with family members or other significant adults.[13] While research suggests such relationships can reduce the risks of health-harming behaviours and poor mental health in those that suffer ACEs,[15] relatively few studies have measured such effects.

In Europe, the 'Roadmap to Implementing the 2030 Agenda for Sustainable Development, Building on Health 2020, the European Policy for Health and Well-being'[16] provides a framework that places strategic focus both on determinants that drive health inequalities (such as ACEs) and on establishing resilient communities (which are in part a product of resilient individuals[17]). Further, the 53 Member States of the World Health Organization (WHO) European Region have adopted 'Investing in Children: The European Child Maltreatment Prevention Action Plan',[2] which aims to reduce child maltreatment through implementing prevention programmes that address risk and protective factors. In line with these and other key health policies, the WHO Regional Office for Europe has led a programme of work to prevent child maltreatment and other ACEs. This now includes ACE studies among young adults in 13 countries, and previous analyses of a selection of these studies identified strong relationships between ACEs and health-harming behaviours.[18] A core commitment of the '2030 Agenda for Sustainable Development' is ensuring 'no-one is left behind', and consequently supporting those who suffer ACEs requires understanding both the potential impacts of ACEs on health and factors that may ameliorate such impacts. Of the 13 countries that have conducted ACE surveys, 10 collected consistent data not only on ACEs, but also on a range of health outcomes and measures of supportive relationships in childhood. Here, we use this large dataset to explore associations between the number of ACEs individuals suffered (as an indicator of increasing levels of adversity) and outcomes related to substance use and mental health, and to examine the potentially protective effects of supportive childhood relationships on these associations.

Methods

We combined data from surveys of young adults in educational settings in the Czech Republic, Lithuania, Republic of Moldova, Montenegro, Poland, Romania, the Russian Federation, Serbia, Ukraine and the former Yugoslav Republic of Macedonia. In each country, surveys were coordinated by national violence prevention programme leads, with the support of Ministries of Health and WHO Regional Office for Europe. National ethics committee approval was obtained according to national regulations. Sampling procedures varied between countries but most used stratified random samples of higher educational institutions and students. Information on sampling procedures, survey dates (2010–17), settings (universities, colleges, vocational academies) and participation rates (≥75%) for each country are summarized in Supplementary table 1. All surveys used the Family Health History questionnaire developed by the US Centers for Disease Control and Prevention and Kaiser Permanente[19] to measure ACEs, supportive childhood relationships and outcomes. Questionnaires were translated and piloted in each country prior to survey implementation. In some countries, questions were varied to suit local situations (see Supplementary table 2). A total of 17 091 respondents participated. However, for this study analysis was limited to those aged 18–25 years ($n = 16\,219$) who provided data for all ACE questions ($n = 14\,675$) and at least three supportive relationships questions (final sample, $n = 14\,661$).

Nine ACEs in participants' first 18 years of life were measured: physical abuse; emotional abuse; sexual abuse; parental separation or divorce; witnessing domestic violence and living with a household member who was depressed or suicidal; a problem drinker/alcoholic; a drug user or incarcerated (Supplementary table 2). The number of ACEs each respondent reported was summed and allocated to an ACE count category (0 ACEs, 1 ACE, 2–3 ACEs or ≥4 ACEs). Six questions measured supportive childhood relationships asking whether (in the first 18 years of life) participants: had someone in their family to help them feel important or special; felt loved; knew there was someone to take care of and protect them; whether people in their family looked out for each other; felt close to each other and whether their family was a source of strength and support. Response options were 'never', 'rarely true', 'sometimes true', 'often true' and 'very often true'. Responses of 'often true' or 'very often true' were classed as positive and individuals with ≤3 (of six) positive responses were categorized as having low supportive relationships. For cases providing data for three to five questions only ($n = 421$), missing responses were set to the mean of answered questions. Cases missing data for >3 questions ($n = 14$) were excluded. Cronbach's alpha for the six questions was 0.828 across the whole sample and ranged from 0.735 in Macedonia to 0.893 in Poland.

Health-related variables included: current smoking, early alcohol initiation (<15 years), problem alcohol use (lifetime), drug use (lifetime), receiving therapy (lifetime) and suicide attempt (lifetime; Supplementary table 2). The question on receiving therapy referred to whether participants had ever been under the care of a psychologist, psychiatrist or therapist and is used here as a proxy for mental health conditions. Demographic variables included country, gender, age group and childhood socio-economic status (SES). Participants were classed as having low childhood SES if they reported any of three markers: low parental education, based on their father (or mother if father's data not provided) having no education, being illiterate, not completing secondary school, or attending elementary/primary education only; reporting their family did not own their own home for most of their childhood; and reporting they did not have enough to eat at some point in childhood.

Analyses were undertaken in SPSS v24 using chi-squared and logistic regression to examine independent relationships between ACEs, supportive childhood relationships and outcomes. Stratified logistic regression models included ACE count, supportive childhood relationships, age group, gender and childhood SES. An interactive term between ACE count and supportive childhood relationships was also included to examine any differences in the moderating effects of supportive relationships on outcomes related to ACEs. Survey country was included as a separate stratum to account for unmeasured differences between samples. For outcomes significantly ($P < 0.05$) related to both ACE count and supportive childhood relationships, adjusted means (estimated marginal means) for each ACE and childhood support category were calculated using generalized linear modelling and best fit logistic regression models (including variables that contributed significantly to each model). Differences between adjusted means were tested using pairwise contrast (Wald chi-squared test) functions.

Table 1 Overall and country-level sample characteristics

		All (%) (n = 14 661)	Czech Republic (%) (n = 1677)	Lithuania (%) (n = 1398)	Republic of Moldova (%) (n = 1351)	Montenegro (%) (n = 1084)	Poland (%) (n = 1655)	Romania (%) (n = 1542)	Russian Federation (%) (n = 1403)	Serbia (%) (n = 2074)	TFYR Macedonia (%) (n = 1200)	Ukraine (%) (n = 1277)	χ^2	P
Gender	Male	39.6	28.6	32.8	37.5	47.7	57.2	37.4	40.1	34.5	40.2	43.7	393.169	<0.001
	Female	60.4	71.4	67.2	62.5	52.3	42.8	62.6	59.9	65.5	59.8	56.3		
Age group	18–19	39.8	23.1	34.5	26.6	56.8	24.3	14.7	32.8	75.8	60.0	47.6	3399.4	<0.001
	20–21	41.1	35.8	60.9	47.7	36.1	59.1	47.8	39.5	23.0	28.7	35.7		
	22–25	19.0	41.1	4.6	25.6	7.1	16.6	37.5	27.7	1.2	11.3	16.7		
Childhood SES	Not low	79.5	90.0	78.2	77.5	75.2	81.8	72.0	72.5	84.2	78.8	80.0	261.202	<0.001
	Low	20.5	10.0	21.8	22.5	24.8	18.2	28.0	27.5	15.8	21.3	20.0		
ACE count	0	53.8	47.2	49.8	55.1	59.9	48.5	47.6	59.9	60.8	69.3	41.7	406.090	<0.001
	1	23.5	25.5	24.3	21.4	21.6	26.1	24.7	20.6	22.1	19.8	28.3		
	2–3	17.1	20.2	19.0	16.9	14.7	19.2	20.2	14.7	13.7	9.0	22.6		
	≥4	5.6	7.0	6.9	6.6	3.9	6.2	7.5	4.8	3.3	1.9	7.4		
Supportive childhood relationships	Higher	83.8	80.2	83.1	82.0	89.7	81.6	85.5	77.5	90.8	83.3	82.5	173.808	<0.001
	Low	16.2	19.8	16.9	18.0	10.3	18.4	14.5	22.5	9.2	16.8	17.5		

Notes: ACE, adverse childhood experiences; SES, socio-economic status; TFYR Macedonia, the former Yugoslav Republic of Macedonia.

Results

Variations between countries in sample demographics and proportions reporting ACEs and low supportive childhood relationships are shown in table 1 (and Supplementary table 3). Just under half (46.2%) of participants reported at least 1 ACE and 5.6% reported ≥4 ACEs (table 1). The most common ACE reported was parental separation (17.0%) and the least common was household drug use (2.7%; Supplementary table 3). Cross-over between ACE types is shown in Supplementary table 4. Emotional abuse and domestic violence were most likely to co-occur with other ACEs, with 92.2 and 86.6% of those reporting these ACEs respectively having at least one other ACE. Emotional abuse typically co-occurred with physical abuse, while over 4 in 10 of those witnessing domestic violence also reported household alcohol abuse, physical abuse and/or parental separation. One in six participants (16.2%) was categorized as having low supportive childhood relationships. The proportion with low supportive relationships increased with ACE count (0 ACEs, 9.4%; 1 ACE, 15.3%; 2–3 ACEs, 27.0%; ≥4 ACEs 53.4%; χ^2=1318.107, $P < 0.001$).

Bivariate relationships between outcomes and demographics, ACEs and childhood relationships are presented in table 2. More males than females reported current smoking, early alcohol initiation, problem alcohol use and drug use, whereas more females reported suicide attempt. Smoking, drug use and therapy were more commonly reported by older participants. All outcomes were associated with low childhood SES and having low supportive childhood relationships. Proportions reporting all outcomes increased with ACE count (table 2).

Cumulative associations between ACE count and outcomes remained in multivariate analyses (table 3). Risks were significantly elevated even in those with 1 ACE and greatest in those with ≥4 ACEs. Thus, compared with those with no ACEs, those with ≥4 ACEs were twice as likely to report current smoking and early alcohol initiation, around 4 times as likely to report problem alcohol use and drug use, 6 times as likely to report therapy and 17 times more likely to have attempted suicide. Low supportive childhood relationships was independently associated with smoking, problem drinking, therapy and suicide attempt but not with early alcohol initiation and drug use. Interactive terms exploring differences in relationships between outcomes and supportive relationships at different ACE counts were not significant.

For outcomes associated with both ACE count and supportive childhood relationships, modelling estimated absolute differences in each outcome by ACE count, stratified by supportive childhood relationship status (figure 1a–d). Across ACE count levels, adjusted proportions of suicide attempt were approximately halved when childhood support was higher. Thus, in those with ≥4 ACEs, suicide attempt reduced from 23% with low supportive childhood relationships to 13% with higher childhood support (figure 1d). Equivalent reductions (in those with ≥4 ACEs) were from 25 to 20% for therapy, from 23 to 17% for problem drinking and from 34 to 32% for smoking (figure 1a–c).

Discussion

European health policy promotes a life-course approach that includes strategies to address the determinants of health, build resilient communities and ensure 'no-one is left behind'.[16] This study adds to a growing evidence base suggesting childhood adversity is a major determinant of poor health.[4] Across samples of young adults from 10 European countries, we found the more ACEs individuals reported, the more likely they were to have adopted substance use (cigarettes, alcohol and drugs) and developed poor mental health. While ACEs were positively correlated with all outcomes, relative increases in risk varied considerably. Compared with individuals with no ACEs, those with ≥4

Table 2 Bivariate relationships between outcome variables and demographics, ACE count and supportive childhood relationships

		Current smoker	Early alcohol initiation	Problem alcohol use	Drug use	Therapy	Suicide attempt
All	n	14 534	14 381	14 553	14 610	14 396	14 574
	%	22.7	18.9	7.5	16.1	8.7	3.5
Gender	Male	26.5	25.6	10.0	20.6	8.7	2.3
	Female	20.2	14.5	5.9	13.2	8.6	4.3
	χ^2	79.554	273.368	83.925	138.456	0.090	41.215
	P	<0.001	<0.001	<0.001	<0.001	0.764	<0.001
Age group	18–19	20.1	19.4	7.2	12.3	8.8	3.3
	20–21	23.5	18.9	7.4	18.7	8.1	3.6
	22–25	26.2	17.9	8.6	18.6	9.7	3.7
	χ^2	44.262	2.695	5.881	102.986	6.582	1.585
	P	<0.001	0.260	0.053	<0.001	0.037	0.453
Childhood SES	Not low	22.3	18.5	6.5	15.7	8.1	2.7
	Low	24.3	20.3	11.6	17.9	10.7	6.7
	χ^2	5.326	4.774	90.205	8.686	19.019	114.558
	P	0.021	0.029	<0.001	0.003	<0.001	<0.001
ACE count	0	18.7	15.3	4.6	10.8	4.7	0.9
	1	24.6	20.8	8.3	18.3	8.6	2.6
	2–3	29.3	24.6	11.7	24.8	15.8	7.4
	≥4	32.7	27.6	19.2	31.7	25.5	20.0
	χ^2	187.993	165.192	322.284	463.572	605.318	927.148
	P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Supportive childhood relationships	Higher	21.7	18.0	6.5	15.3	7.6	2.3
	Low	27.7	23.4	13.0	20.8	14.4	9.5
	χ^2	41.535	36.922	120.119	44.690	114.782	302.908
	P	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes: ACE, adverse childhood experiences; SES, socio-economic status.

ACEs were twice as likely to report early alcohol initiation and current smoking. However, they were around four times as likely to report drug use or problem alcohol use. Outcomes related directly to mental health showed the greatest increases in risk, with accessing therapy 6 times more likely in those with ≥4 ACEs (vs. none) and attempted suicide 17 times more likely. The strength of these relationships reflects other work showing outcomes with a strong mental health component to be highly affected by ACEs.[4,20]

Mental disorders are a leading cause of disease burden among 15–49-year-olds in the WHO European region.[21] They are estimated to affect over a third of the Region's population each year and WHO highlight the need for accelerated progress in this area.[16] The European mental health action plan (2013–20)[22] already emphasizes the importance of reducing ACEs by raising awareness, increasing recognition and ensuring early intervention. There is a developing evidence base for programmes that prevent ACEs.[23,24] Such interventions include home visiting programmes[25] and parenting programmes,[26] which can prevent child maltreatment, improve parenting skills and strengthen parent–child relationships. They also provide opportunities for professionals to identify and assist parents with difficulties including mental illness, substance misuse and domestic violence.[27]

Over half of participants that reported witnessing domestic violence also reported at least one form of child maltreatment (Supplementary table 4), highlighting the intergenerational nature of violence. In most countries, domestic violence questions focussed on violence towards mothers. Violence against women (VAW) and child maltreatment share many risk factors, including harmful alcohol use, drug use and mental illness and children who suffer abuse are at increased risk of involvement in VAW in later life.[28] The relationships identified in this study also highlight the intergenerational nature of ACEs and ill health,[29] and thus the importance of breaking these cycles. Children that suffer adversity are at increased risk of developing behaviours (e.g. substance use) and conditions (e.g. mental illness) that can later become ACEs for their own children; consequently increasing the risk of such behaviours and conditions being transmitted across

generations. Evidence-based frameworks for preventing violence against children have been developed by WHO and international partners.[30]

While preventing ACEs is critical, equally important is developing and enhancing factors that provide protection to those exposed to ACEs.[31] Despite the concept of resilience increasingly featuring in health and social policy, evidence on assets that provide resilience against the poor outcomes associated with ACEs remains limited. The European ACE surveys have allowed initial exploration of potential protective effects associated with supportive childhood relationships; considered the most important foundation of resilience.[13] Supportive relationships with caregivers or other trusted adults enable children to learn to cope with stress and thus develop healthy stress response systems. Such relationships can provide children who suffer ACEs with a 'safe space' to recover, providing protection against the toxic effects of extreme stress on brain development.[32] In the absence of supportive relationships, individuals can develop higher allostatic loads, increasing vulnerability to physical and mental illness.[7] Here, greater childhood support was associated with reduced risk of smoking, problem alcohol use, therapy and suicide attempt. For suicide attempt, the reduction in risk was substantial; among individuals with ≥4 ACEs, prevalence reduced from 23% with low supportive childhood relationships to 13% with higher support. For therapy, smoking and problem alcohol use, reductions were less marked but still significant. However, there were no significant relationships with early alcohol or lifetime drug use. Our study does not provide insight into why these issues did not respond to supportive childhood relationships. However, alcohol provision to children is often by parents who, regardless of the evidence, may believe it to be neutral or even beneficial to child development.[33] Further, drug use was measured on a lifetime basis with no detail on drug type or duration of use. Recreational drug use is common among young Europeans.[34] It may be that supportive childhood relationships have limited impact on such recreational risk taking yet help prevent its transition to continued or problematic levels. Such effects could be explored in future research using longitudinal designs. Alcohol, drug and

Table 3 Adjusted odds ratios for health outcomes in demographic, ACE count and supportive childhood relationship groups

		Current smoker n = 14 534		Early alcohol initiation n = 14 381		Problem alcohol use n = 14 553		Drug use n = 14 610		Therapy n = 14 396		Suicide attempt n = 14 574	
		AOR	(95% CIs)	AOR	(95% CIs)	AOR	(95% CIs)	AOR	(95% CIs)	AOR	(95% CIs)	AOR	(95% CIs)
Country	(Ref) Romania												
	Czech Republic	0.73	(0.62–0.85)	1.00	(0.83–1.20)	0.50	(0.36–0.70)	1.30	(1.08–1.58)	1.98	(1.55–2.52)	0.73	(0.50–1.08)
	Lithuania	1.05	(0.89–1.24)	2.90	(2.44–3.45)	1.40	(1.06–1.84)	2.82	(2.33–3.41)	0.36	(0.25–0.53)	1.10	(0.76–1.59)
	Republic of Moldova	0.33	(0.27–0.40)	0.90	(0.74–1.10)	2.02	(1.56–2.62)	0.60	(0.47–0.76)	0.86	(0.63–1.17)	0.72	(0.47–1.10)
	Montenegro	0.42	(0.35–0.52)	0.90	(0.73–1.11)	1.31	(0.98–1.77)	0.79	(0.61–1.01)	1.52	(1.13–2.04)	0.95	(0.60–1.52)
	Poland	0.42	(0.35–0.50)	0.63	(0.52–0.76)	0.68	(0.51–0.91)	3.77	(3.15–4.51)	2.22	(1.74–2.83)	1.39	(0.97–1.99)
	Russian Federation	0.59	(0.50–0.70)	0.48	(0.38–0.60)	1.73	(1.32–2.25)	0.33	(0.25–0.44)	0.39	(0.27–0.57)	1.20	(0.82–1.75)
	Serbia	0.55	(0.47–0.65)	0.88	(0.73–1.05)	1.14	(0.87–1.49)	1.15	(0.93–1.42)	1.69	(1.32–2.17)	0.62	(0.41–0.94)
	TFYR Macedonia	0.91	(0.76–1.08)	1.66	(1.37–2.00)	1.18	(0.87–1.60)	0.46	(0.34–0.61)	0.72	(0.50–1.02)	1.31	(0.85–2.03)
	Ukraine	0.56	(0.47–0.67)	0.97	(0.80–1.17)	1.14	(0.86–1.51)	0.93	(0.75–1.16)	2.13	(1.65–2.75)	0.97	(0.66–1.42)
Gender[a]	Female	0.65	(0.60–0.70)	0.44	(0.40–0.48)	0.55	(0.48–0.62)	0.61	(0.55–0.67)	ns		2.12	(1.71–2.63)
Age group	(Ref) 18–19												
	20–21	1.16	(1.06–1.28)					1.30	(1.16–1.46)				
	22–25	1.26	(1.12–1.42)					1.59	(1.38–1.84)				
Childhood SES[a]	Low					1.30	(1.12–1.50)					1.36	(1.11–1.67)
ACE count	(Ref) 0												
	1	1.39	(1.26–1.53)	1.44	(1.29–1.60)	1.88	(1.59–2.21)	1.71	(1.52–1.93)	1.78	(1.51–2.09)	2.70	(1.97–3.69)
	2–3	1.79	(1.60–1.99)	1.92	(1.71–2.16)	2.70	(2.28–3.20)	2.60	(2.30–2.93)	3.47	(2.97–4.06)	6.83	(5.14–9.07)
	≥4	2.01	(1.70–2.38)	2.25	(1.89–2.68)	4.32	(3.45–5.41)	3.72	(3.12–4.43)	6.17	(5.00–7.60)	17.68	(12.93–24.17)
Supportive childhood relationships[a]	Low	1.12	(1.01–1.25)	ns		1.39	(1.19–1.62)	ns		1.34	(1.15–1.56)	2.03	(1.66–2.49)

Notes: ACE, adverse childhood experiences; AOR, adjusted odds ratio; 95% CIs, 95% confidence intervals; ns, not significant; Ref, reference category; SES, socio-economic status. Interactive terms exploring differences in relationships between outcomes and supportive relationships at different ACE counts were not significant in any model and therefore have not been included in the table. Iterative steps for associations between ACEs and outcome measures are shown in Supplementary table 5.
a: Reference categories for gender, childhood SES and supportive childhood relationships are male, not low and higher respectively.

tobacco use are leading risk factors for disease burden in Europe.[21] Currently, however, addressing ACEs as an underlying contributor to harmful substance use is typically missing from national and international policy.

While findings indicate benefits to individuals that suffer ACEs from supportive childhood relationships, they also show these individuals are less likely to have such relationships. Over half of those with ≥4 ACEs had low childhood support compared with less than 1 in 10 of those with no ACEs. While programmes that strengthen family relationships can foster such support within the home, where this is not possible, ensuring children have access to trusted and supportive relationships through extended families, communities or public services may help bridge this gap.[35] Ensuring children exposed to toxic stress receive therapeutic and other support is also essential and the forthcoming WHO guidelines for the health sector response to child maltreatment will highlight effective support programmes.[36]

This study has a number of limitations. Samples were recruited in higher educational settings and may under-represent young adults from more socially deprived groups, who can be disproportionately affected by ACEs.[23,37] Equally, ACEs are associated with poorer educational attainment[5] and individuals suffering the greatest burden from ACEs are less likely to reach higher education. Like other retrospective ACE surveys, findings may be affected by recall or reporting issues, while cultural and resource differences between countries may affect reporting of certain behaviours or experiences as well as access to services (i.e. for therapy). While therapy was used here as a proxy for mental health conditions, the actual prevalence of

such conditions is likely to be higher as not all those affected will seek such services or have access to them. Questionnaires were piloted in each country prior to implementation and our analysis accounted for differences between country samples. While the ACE tool has been used across multiple countries, there is limited data available on its psychometric properties. However, adapted versions have been validated,[38,39] and retrospective reports of easily-defined ACEs such as those measured here are considered to have acceptable psychometric properties.[40] Finally, our study design is cross-sectional; for most ACEs (except sexual abuse, see Supplementary table 2) age of first exposure was not recorded while outcome measures were largely measured on a lifetime basis; this limits inference on causality.

Conclusions

Evidence demonstrating the life-long harms to health and social well-being from ACEs continues to grow. Our study has identified substantially increased risks of substance use and mental illness faced by young Europeans that have suffered ACEs. The European ACE studies are building awareness of the impact of ACEs across the region and driving action to prevent and respond to them.[10] Equally important is ensuring that children who suffer ACEs receive appropriate support, including opportunities to develop resilience to help avoid the harmful effects of early toxic stress. Supportive childhood relationships are considered a key foundation of resilience and our findings indicate their potential protective effects against the
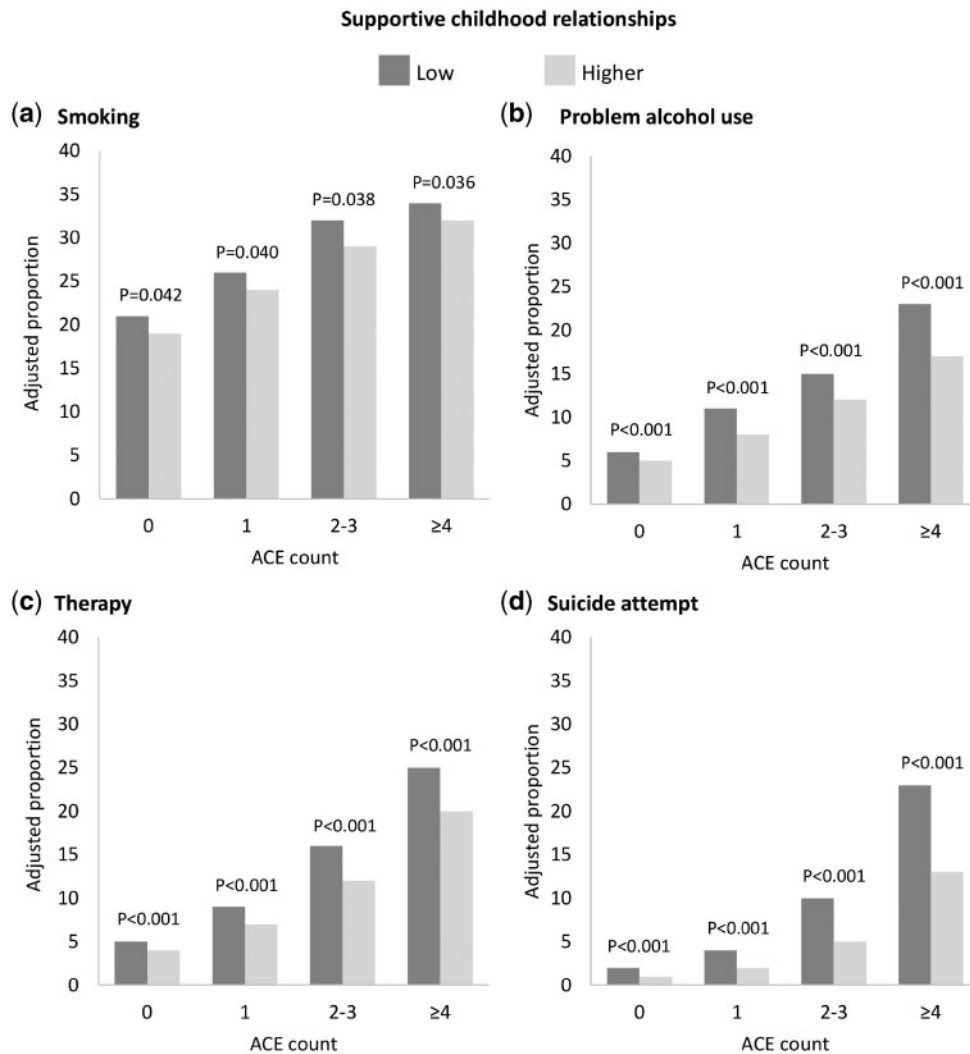
Figure 1 Adjusted mean percentage with each health outcome (a, smoking; b, problem alcohol use; c, therapy; d, suicide attempt) by ACE count, stratified by supportive childhood relationships. Note: Adjusted means are calculated using all significant terms in the logistic regression models for each outcome (see table3). No figure is included for early alcohol initiation or drug use as supportive childhood relationships did not contribute significantly to the model

development of harmful substance use and mental illness. However, resilience does not provide a panacea to ACEs. Developing multi-agency approaches that implement effective early prevention at scale along with resilience building opportunities for those affected by ACEs is essential in breaking cycles of ACEs and ill health, and consequently a critical aspect of achieving European health policy.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

Key points

- Almost half of young adult students surveyed across 10 European countries reported having suffered at least one adverse childhood experience.
- Risks of smoking, early alcohol initiation, problem alcohol use, drug use, suicide attempt and therapy increased with the number of ACEs suffered.
- Supportive childhood relationships were independently associated with reduced risks of smoking, drug use, suicide attempt and having used therapy; even in those that suffered ACEs.
- Early interventions that prevent ACEs such as child maltreatment and strengthen family relationships are critical in establishing children on a healthy life-course.
- Children that suffer ACEs and lack supportive relationships within the home environment may benefit from developing support through extended family, communities and public services.

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