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Acknowledgements

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Impacts on **health**, **wellbeing** and **resilience**

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Adverse childhood experiences (ACEs) in Bolton: Impacts on health, wellbeing and resilience

1,876 adults aged 18+ took part in the *Childhood Adversity and Health and Wellbeing during COVID-19* Study in Bolton Local Authority. The survey measured exposure to a range of adverse childhood experiences (ACEs) and relationships with health, wellbeing and resilience. Data was collected between December 2020 - March 2021. Unless stated otherwise, results are adjusted to Bolton mid-2019 adult population estimates.

How many adults in Bolton have suffered each ACE?

Child maltreatment

Verbal abuse	Physical abuse	Sexual abuse
23%	**16%**	**8%**

Childhood household included

Parental separation	Mental illness	Domestic violence	Alcohol abuse	Drug abuse	Incarceration
23%	**16%**	**16%**	**12%**	**4%**	**4%**

For every 100 adults in Bolton, 52 had at least one ACE and 11 had four or more

- 0 ACEs 48%
- 1 ACE 23%
- 2-3 ACEs 18%
- 4+ ACEs 11%
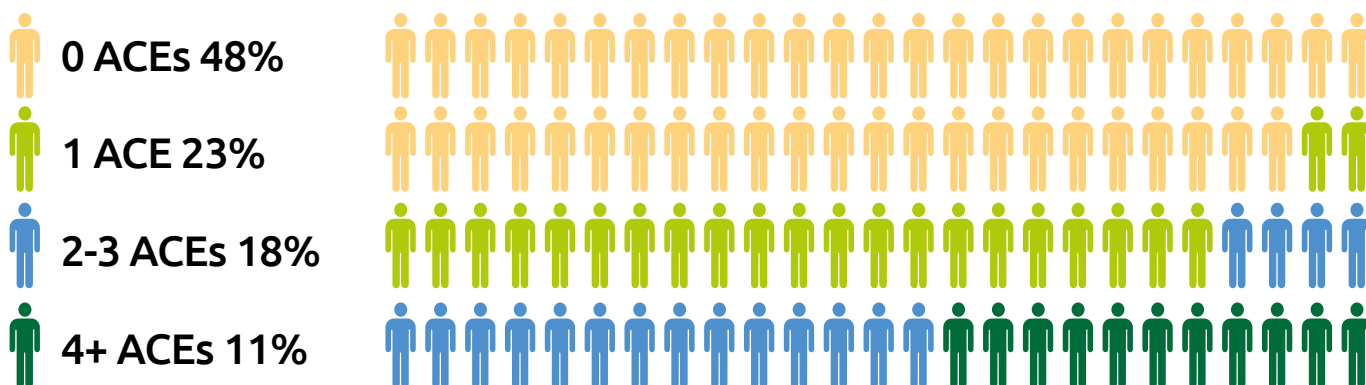
Compared with people with no ACEs, those with 4+ ACEs were:

2 times more likely **to have smoked cigarettes in the last year**

3 times more likely **to have smoked cannabis**

6 times more likely **to have used other street drugs**

8 times more likely **to have been a victim of violence over the last year**

5 times more likely **to have been a perpetrator of violence in the last year**

ACEs increased the risk of mental illness

Compared with individuals with no ACEs, those with 4+ ACEs were:

2 x more likely to report **poor mental health**[a]

2 x more likely to report **poor sleep**[a]

3 x more likely to report **anti-depressant use**[b]

4 x more likely to report **mental illness diagnosis**[b]

5 x more likely to report **addiction diagnosis**[b]

ACEs increased the risk of poor physical health.
Compared to those with no ACEs, those with 4+ were:

3 times more likely **to have poor physical health**[c]

2 times more likely **to have cancer**

2 times more likely **to have type 2 diabetes**

2 times more likely **to have coronary heart disease**[d]

2 times more likely **to have respiratory disease**[e]

2 times more likely **to have irritable bowel syndrome**[f]

Individuals with ACEs reported lower resilience resources

% reporting low levels of each resilience resource

- 0 ACEs
- 4+ ACEs

No close trusted family members
- 3%
- 11%

No close trusted friends
- 8%
- 11%

Low ability to handle unpleasant or painful feelings
- 21%
- 36%

Not knowing where to get help in the community
- 25%
- 33%

Low childhood resilience resources
- 5%
- 34%
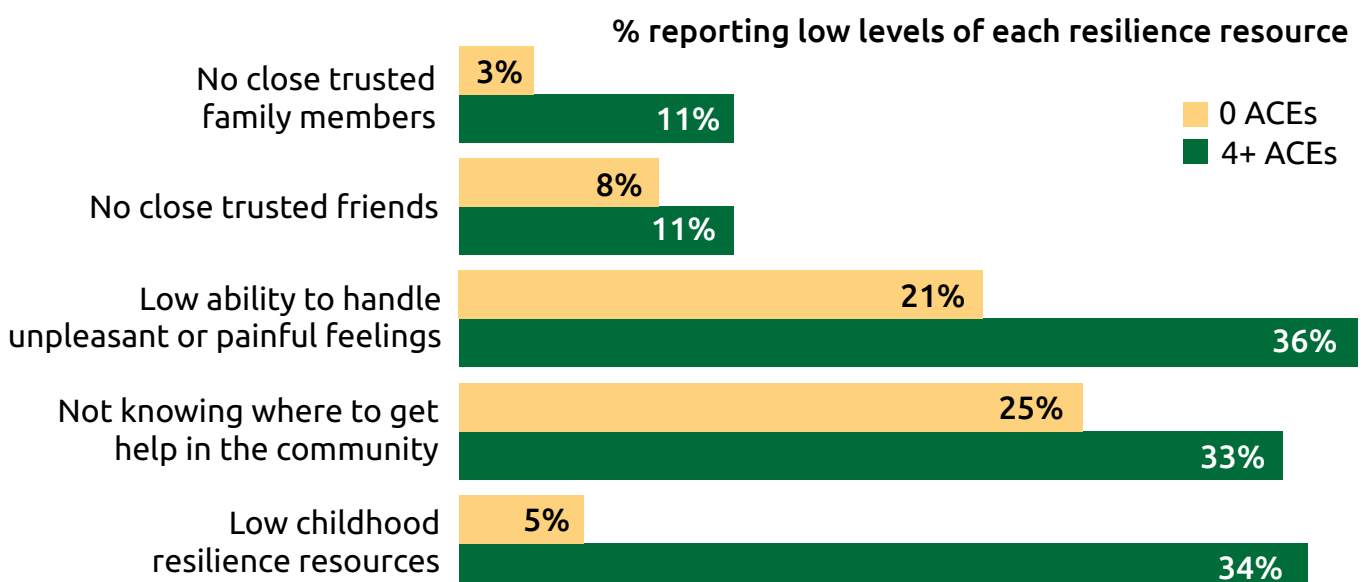
1. Background

There is substantial evidence identifying the detrimental impacts that adverse childhood experiences (ACEs) can have on individuals' health, wellbeing and broader life opportunities. ACEs are stressful events in childhood such as suffering child maltreatment, witnessing domestic violence and exposure to other family difficulties such as parental alcohol misuse or mental illness. Such experiences have been shown to be associated with a wide range of negative life course harms including poor educational attainment, the adoption of health-harming behaviours such as smoking and drug use, and involvement in violence and crime [1–3]. ACEs are also linked to the development of a wide range of physical health conditions, including cancer, respiratory disease, type 2 diabetes and cardiovascular disease; contributing to premature mortality [3–8]. Further, particularly strong relationships exist between ACEs and poor mental health and wellbeing [4,9,10]. However, not all individuals who are exposed to ACEs suffer these negative outcomes. Research shows that resilience resources (e.g. trusted relationships) in both childhood and adulthood can play an important role in mitigating the harms associated with ACEs [11–13].

A number of studies in the UK have identified the prevalence and impacts of ACEs at a national level (England [6]; Wales [11,14]; Scotland [15]), yet few studies have been undertaken at a local level [7,16]. Understanding how local populations are affected by ACEs can enable local authorities and partnerships to tailor their support services, targeting resources to the health needs of the populations they serve. This is particularly important in light of the COVID-19 pandemic, which has impacted populations globally and exacerbated existing health inequalities.

To date, no research has been undertaken to explore the prevalence and impacts of ACEs in Bolton. The 2030 Vision for Bolton prioritises the improvement of residents' health and wellbeing so they can live healthier and satisfying lives for longer [17]. To help meet their vision, *The Childhood Adversity and Health and Wellbeing during COVID-19 Study* was implemented by Public Health Wales and Bangor University on behalf of Bolton Council to understand the impact of ACEs on the health and wellbeing of adults in the Bolton Local Authority area. The study explores:

- The prevalence of ACEs in Bolton Local Authority;
- Relationships between ACEs and health and wellbeing;
- Resilience factors that may offer protection against the harmful impacts of ACEs.

Such data are critical to understand the health needs of individuals in Bolton and support the development of appropriate responses.

2. Methods

The Childhood Adversity and Health and Wellbeing during COVID-19 Study utilised a stratified sampling approach to interview residents of Bolton local authority aged 18 years and over. Surveys were conducted by telephone and online by a professional market research company (DJS Research) between 15th December 2020 and 25th March 2021. The full methodology and the demographic breakdown of participants are detailed in Appendix 1. In total 1,895 residents participated in the study, with 87.5% (n=1,658) completing a telephone survey and 12.5% (n=237) completing the survey online. For the purpose of this report, individuals who did not answer all demographic questions, or for whom an ACE count measure could not be generated (identifying the number of ACEs suffered in childhood, see section 2.2) were excluded (n=19). Thus, analyses use a sample of 1,876 (87.5% telephone, 12.5% online).

2.1 Study questionnaire

The study questionnaire was developed by the research team in collaboration with Bolton Council. Survey questions included: participant demographics (age, sex, ethnicity); exposure to nine ACE types during childhood (measured using an established tool [18]; see Figure 1 and Appendix 1); health-harming behaviours (binge drinking, cigarette use, drug use, low levels of physical activity); involvement in violence in the past year (victimisation and perpetration); mental health and wellbeing (current mental health, mental illness diagnosis, addiction diagnosis, current sleep quality, lifetime anti-depressant use); physical health (current self-rated physical health, lifetime diagnosis of cancer and other chronic conditions) and resilience (childhood resilience, close relationships, current resilience resources). All measures were self-reported. See Appendix 1 for full details of the questions asked. Postcode of residence was collected by the market research company and converted to Lower Super Output Area (geographic areas with an average population of 1,600) for categorisation to an Index of Multiple Deprivation (IMD) quintile [19]. The IMD is a standardised measure for comparing deprivation between small localities.

2.2. Data analysis

In line with international literature [4,6], analyses explored ACEs using a count variable that categorised participants based on the number of ACEs they reported having experienced during childhood (before the age of 18): no ACEs, one ACE, two to three ACEs and four or more ACEs. Estimates of the prevalence of ACEs and outcomes of interest, and the prevalence of outcomes within ACE categories, use data weighted to reflect the Bolton adult population (using mid-2019 population estimates by age, sex, and IMD quintile). Independent relationships between ACEs and all outcomes of interest are then explored using logistic regression analysis (unweighted data), controlling for socio-demographics (age, sex, ethnicity, and IMD quintile) and survey type (online or telephone). For health conditions, survival analyses were undertaken using cox regression to take age effects into account.

2.3. Presentation of findings

Section 3 details ACE prevalence levels in Bolton at individual ACE type and ACE count levels. Subsequent sections explore the following topics and their association with ACEs: health-harming behaviours (Section 4), mental health (Section 5), physical health (Section 6), and resilience (Section 7).

3. ACE Prevalence

Just over half (51.7%) of Bolton residents aged 18 years and over reported exposure to at least one ACE during their first 18 years of life, with approximately one in ten (10.8%) reporting exposure to four or more (≥4) ACE types. Across the nine ACEs measured, individual ACE prevalence ranged from 3.8% for household member incarceration to 23.4% for parental separation or divorce (See Figure 1 and Appendix Table A1).

Figure 1. Weighted prevalence[a] of individual ACEs and ACE count in the Bolton population (aged 18+ years)
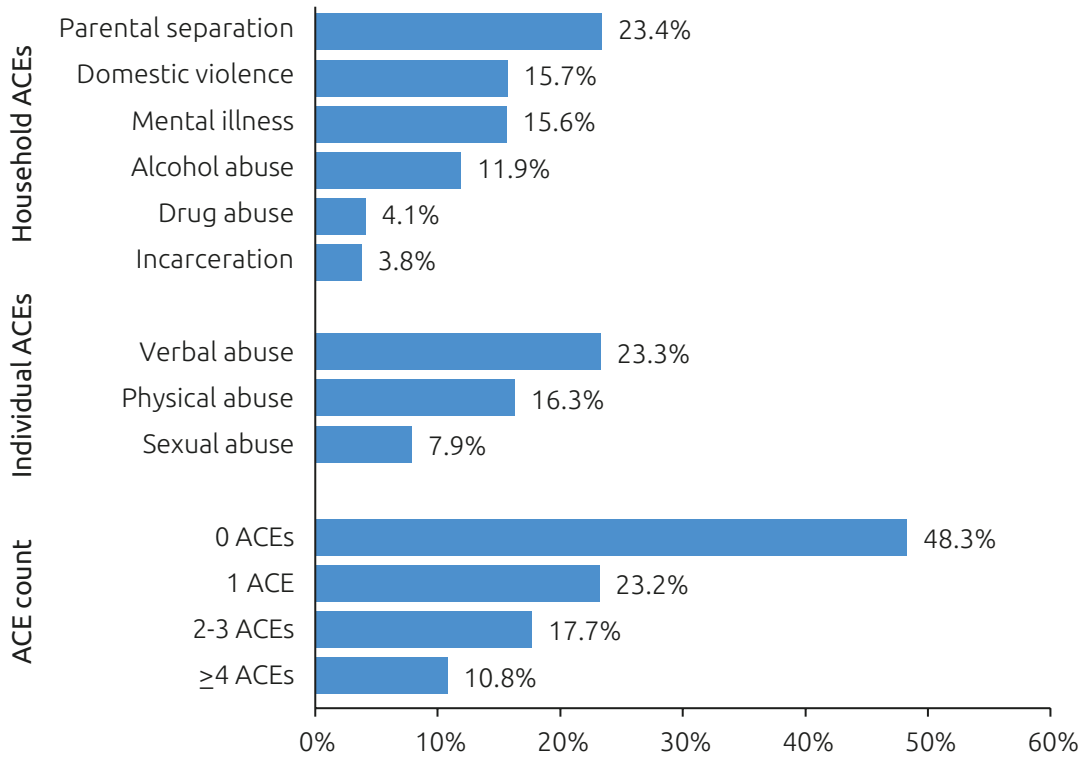
[a]Figures weighted to mid-2019 Bolton population estimates.

4. ACEs and health-harming behaviours

Figure 2. Proportion of adults reporting health-harming behaviours by ACE count[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	Binge drinking[b]	Cigarette use[b]	Cannabis use[c]	Other street drug use[c]	Physical inactivity[b]
	AOR	AOR	AOR	AOR	AOR
1 ACE	1.4*	1.0	1.3	2.8*	1.0
2-3 ACEs	1.2	1.4	1.9*	4.8**	1.3
≥4 ACEs	1.3	1.7*	2.7**	5.9**	1.4

[a]Weighted data; [b]Current outcome; [c]Lifetime outcome; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

Binge drinking

Participants were asked on how many days a week they drank five or more alcoholic drinks. Those reporting doing so at least one day a week were coded as binge drinking

Almost a quarter (23.4%) of adults reported binge drinking. Prevalence of binge drinking increased from 19.2% of those with 0 ACEs to 29.6% of those with ≥4 ACEs (Figure 2).

After controlling for demographic confounding, individuals with 1 ACE were 1.4 times more likely to report binge drinking than individuals with no ACEs (Appendix 2, Table A2). However, the increase in risk in those with 2-3 or ≥4 ACEs did not reach significance.

> **23%**
> of adults reported **binge drinking**

Cigarette use

Participants were asked if they had ever used cigarettes. Those responding 'used in the last 12 months' were coded as using cigarettes

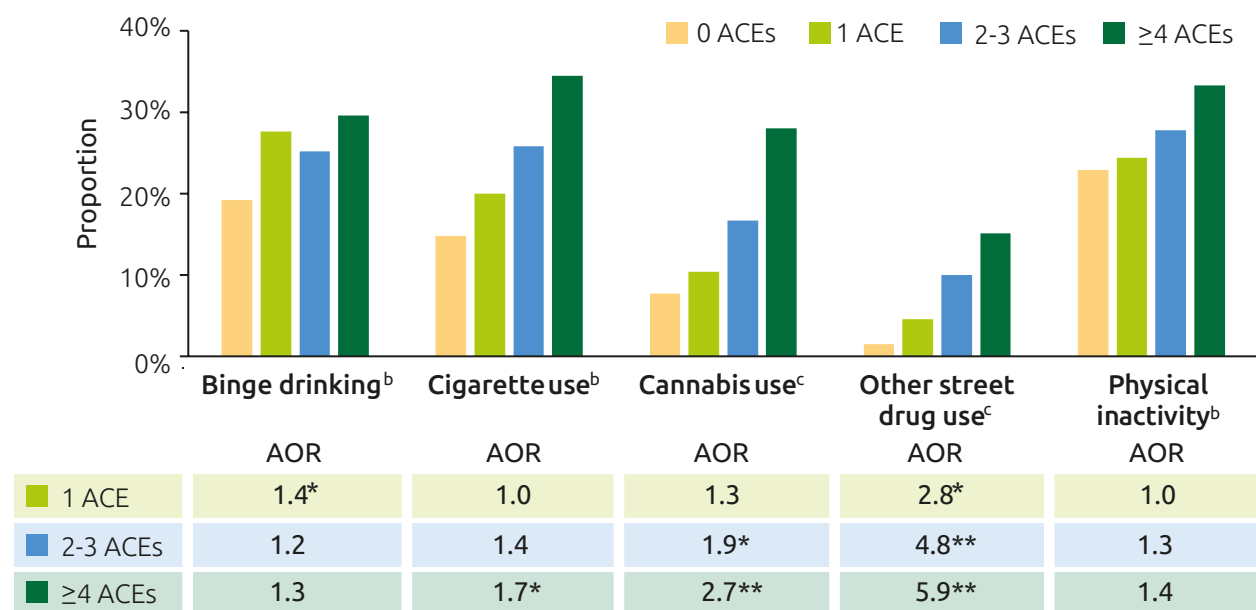One in five (20.1%) adults reported cigarette use. Prevalence increased with ACE count, from 14.8% of those with 0 ACEs to 34.5% of those with ≥4 ACEs (Figure 2).

After controlling for demographic confounding, individuals with ≥4 ACEs were 1.7 times more likely to report cigarette use than those with no ACEs (Appendix 2, Table A2). However, the increases in risk in those with 1 ACE or 2-3 ACEs did not reach significance.

Participants were also asked about their use of e-cigarettes, with 10.8% reporting past year use. Together, a quarter (25.3%) of participants reported past year use of either cigarettes or e-cigarettes, with prevalence increasing with ACE count. However, increased risks in those with ≥4 ACEs did not reach significance after controlling for demographic confounding (Table A2A).

> **20%**
> of adults reported **cigarette use**

> Those with ≥4 ACEs were
> **1.7 times**
> more likely to report cigarette use than those with 0 ACEs#

Lifetime cannabis use

Participants were asked if they had ever used cannabis

Over one in ten (12.1%) adults reported lifetime cannabis use. Prevalence increased with ACE count, from 7.7% of those with 0 ACEs to 28.0% of those with ≥4 ACEs (Figure 2).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.9 times more likely to report cannabis use, and those with ≥4 ACEs were 2.7 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A2). The increase in risk in those with 1 ACE did not reach significance.

12%
of adults reported **cannabis use**

Those with ≥4 ACEs were **2.7 times** more likely to report cannabis use than those with 0 ACEs[#]

Lifetime other street drug use

Participants were asked if they had ever used other street drugs such as cocaine

One in twenty (5.2%) adults reported lifetime use of other street drugs. Prevalence increased with ACE count, from 1.5% of those with 0 ACEs to 15.1% of those with ≥4 ACEs (Figure 2).

After controlling for demographic confounding, individuals with 1 ACE were 2.8 times more likely to report other street drug use, those with 2-3 ACEs were 4.8 times more likely, and those with ≥4 ACEs were 5.9 times more likely (compared with individuals with no ACEs; Appendix 2, Table A2).

5%
of adults reported **other street drug use**

Those with ≥4 ACEs were **5.9 times** more likely to report other street drug use than those with 0 ACEs[#]

Physical inactivity

Participants were asked how many days a week they do at least 30 minutes of physical activity (enough to make them out of breath). Those responding 'no days' were coded as being physically inactive

A quarter (25.2%) of adults reported physical inactivity. Prevalence increased with ACE count, from 22.9% of those with 0 ACEs to 33.3% of those with ≥4 ACEs (Figure 2).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.3 times more likely to report physical inactivity and those with ≥4 ACEs were 1.4 times more likely (compared with individuals with no ACEs). However, these increases failed to reach significance (Appendix 2, Table A2).

25%
of adults reported **physical inactivity**

#after controlling for demographic confounding.

Past year violence involvement

Figure 3. Proportion of adults reporting past year violence involvement by ACE count,[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	Violence victimisation AOR	Violence perpetration AOR
1 ACE	2.0	2.2
2-3 ACEs	4.5**	2.7*
≥4 ACEs	7.9**	4.7*
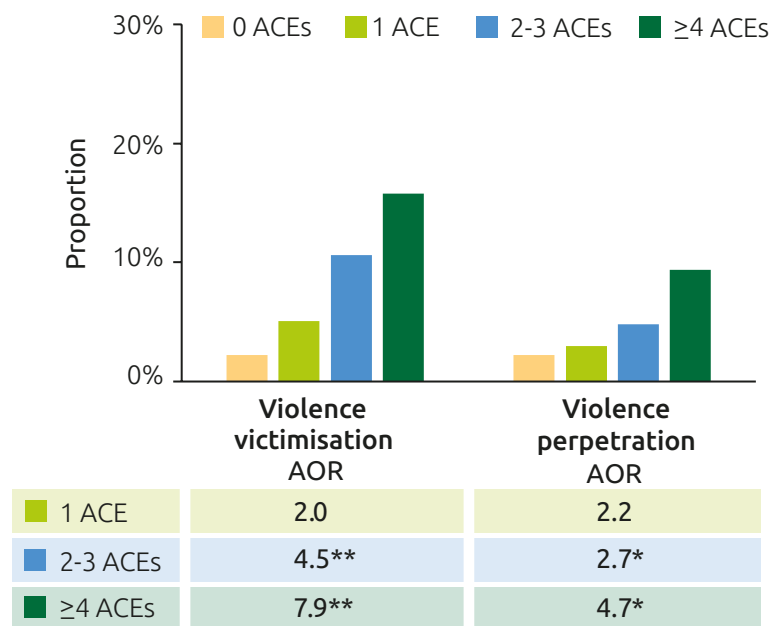
[a]Weighted data; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

Past year violence victimisation

Participants were asked if they had been hit by an adult in the last 12 months

Over one in 20 (5.9%) adults reported past year violence victimisation. Prevalence increased with ACE count, from 2.2% of those with 0 ACEs to 15.8% of those with ≥4 ACEs (Figure 3).

After controlling for demographic confounding, individuals with 2-3 ACEs were 4.5 times more likely to report past year violence victimisation, and those with ≥4 ACEs were 7.9 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A3). The increase in risk in those with 1 ACE was not significant.

> **6%**
> of adults reported **violence victimisation**

> Those with ≥4 ACEs were
> **7.9 times**
> more likely to report violence victimisation than those with 0 ACEs[#]

Past year violence perpetration

Participants were asked if they had hit another adult for any reason, including to defend themselves, in the last 12 months

Less than one in 20 (3.6%) adults reported past year violence perpetration. Prevalence increased with ACE count, from 2.2% of those with 0 ACEs to 9.4% of those with ≥4 ACEs (Figure 3).

After controlling for demographic confounding, individuals with 2-3 ACEs were 2.7 times more likely to report violence perpetration and those with ≥4 ACEs were 4.7 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A3). The increase in risk in those with 1 ACE was not significant.
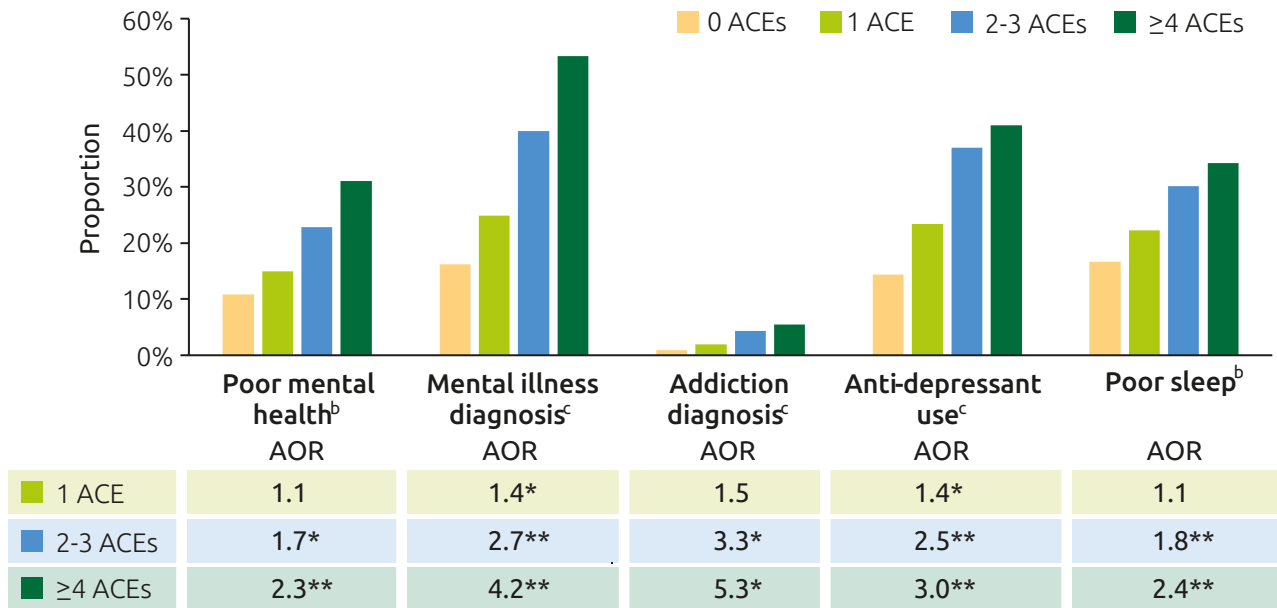
> **4%**
> of adults reported **violence perpetration**

> Those with ≥4 ACEs were
> **4.7 times**
> more likely to report violence perpetration than those with 0 ACEs[#]

#after controlling for demographic confounding.

5. ACEs and mental health outcomes

Figure 4. Proportion of adults reporting mental health outcomes by ACE count,[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	Poor mental health[b] AOR	Mental illness diagnosis[c] AOR	Addiction diagnosis[c] AOR	Anti-depressant use[c] AOR	Poor sleep[b] AOR
1 ACE	1.1	1.4*	1.5	1.4*	1.1
2-3 ACEs	1.7*	2.7**	3.3*	2.5**	1.8**
≥4 ACEs	2.3**	4.2**	5.3*	3.0**	2.4**

[a]Weighted data; [b]Current outcome; [c]Lifetime outcome; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

Current poor mental health

Participants were asked to rate their current mental health using a scale of 0 (extremely poor) to 10 (extremely good). Those who reported scores of ≤4 were coded as having current poor mental health

Over one in ten (16.1%) adults reported current poor mental health. Prevalence increased with ACE count, from 10.9% of those with 0 ACEs to 31.0% of those with ≥4 ACEs (Figure 4).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.7 times more likely to report poor mental health, and those with ≥4 ACEs were 2.3 times more likely (compared with those with 0 ACEs; Appendix 2, Table A4). There was no significant increase in risk with 1 ACE.

16%
of adults reported **poor mental health**

Those with ≥4 ACEs were **2.3 times** more likely to report poor mental health than those with 0 ACEs[#]

Lifetime mental illness diagnosis

Participants were asked if they had ever been told by a doctor or a nurse that they had a mental illness, including depression and anxiety

Over a quarter (26.5%) of adults reported a lifetime mental illness diagnosis. Prevalence increased with ACE count, from 16.2% of those with 0 ACEs to 53.3% of those with ≥4 ACEs (Figure 4).

After controlling for demographic confounding, individuals with 1 ACE were 1.4 times more likely to report a mental illness diagnosis, those with 2-3 ACEs were 2.7 times more likely, and those with ≥4 ACEs were 4.2 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A4).

26%
of adults reported **mental illness diagnosis**

Those with ≥4 ACEs were **4.2 times** more likely to report mental illness diagnosis than those with 0 ACEs[#]

#after controlling for demographic confounding.

Lifetime addiction diagnosis

Participants were asked if they had ever been told by a doctor or a nurse that they had an addiction to alcohol or any type of illegal drug or prescribed medication

Two in 100 (2.2%) adults reported a lifetime addiction diagnosis. Prevalence increased with ACE count, from 0.9% of those with 0 ACEs to 5.5% of those with ≥4 ACEs (Figure 4).

After controlling for demographic confounding, individuals with 2-3 ACEs were 3.3 times more likely to report an addiction diagnosis and those with ≥4 ACEs were 5.3 times more likely (compared with individuals with 0 ACEs; Appendix 2,Table A4). The increase in risk in those with 1 ACE was not significant.

> **2%**
> of adults reported
> **addiction diagnosis**

> Those with ≥4 ACEs were
> **5.3 times**
> more likely to report
> addiction diagnosis than
> those with 0 ACEs[#]

Lifetime anti-depressant use

Participants were asked if they had ever used anti-depressants

Almost a quarter (23.3%) of adults reported lifetime anti-depressant use. Prevalence increased with ACE count, from 14.4% of those with 0 ACEs to 41.0% of those with ≥4 ACEs (Figure 4).

After controlling for demographic confounding, individuals with 1 ACE were 1.4 times more likely to report anti-depressant use, those with 2-3 ACEs were 2.5 times more likely, and those with ≥4 ACEs were 3.0 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A4).

> **23%**
> of adults reported
> **anti-depressant use**

> Those with ≥4 ACEs were
> **3.0 times**
> more likely to report
> anti-depressant use
> than those with 0 ACEs[#]

Poor sleep

Participants were asked to rate how well they are currently sleeping from 0 (extremely poor) to 10 (extremely good). Those reporting scores ≤4 were coded as having poor sleep

Over one fifth (22.3%) of adults reported poor sleep. Prevalence increased with ACE count, from 16.7% of those with 0 ACEs to 34.3% of those with ≥4 ACEs (Figure 4).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.8 times more likely to report poor sleep, and those with ≥4 ACEs were 2.4 times more likely (compared with individuals with 0 ACEs; Appendix 2, Table A4). There was no significant increase in risk in those with 1 ACE.

> **22%**
> of adults reported
> **poor sleep**

> Those with ≥4 ACEs were
> **2.4 times**
> more likely to report
> poor sleep than those
> with 0 ACEs[#]

#after controlling for demographic confounding.

6. ACEs and physical health outcomes

Figure 5. Proportion of adults reporting poor physical health by ACE count,[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	0 ACEs	1 ACE	2-3 ACEs	≥4 ACEs
AOR		1.1	1.7*	2.5**

16%
of adults reported
poor physical health

Those with ≥4 ACEs were
2.5 times
more likely to report
poor physical health
than those with 0 ACEs#

[a]Weighted data; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

Current poor physical health

Participants were asked to rate how healthy their body feels now using a scale of 0 (not at all healthy) to 10 (extremely healthy). Those reporting scores ≤4 were coded as having current poor physical health

Over one in ten (15.8%) adults reported current poor physical health. Prevalence increased with ACE count, from 12.1% of those with 0 ACEs to 27.8% of those with ≥4 ACEs (Figure 5).
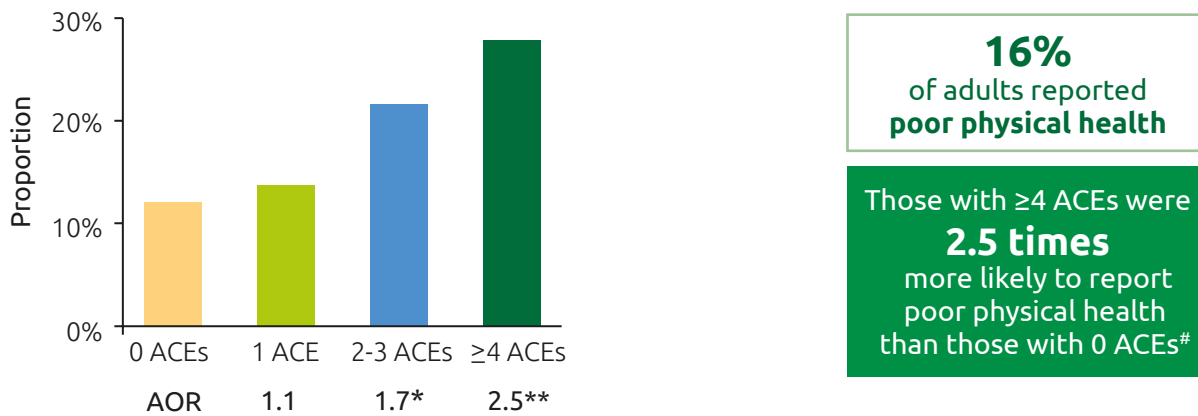
After controlling for demographic confounding, individuals with 2-3 ACEs were 1.7 times more likely to report poor physical health and those with ≥4 ACEs were 2.5 times more likely (compared with individuals with 0 ACEs; Appendix 2 Table A5). There was no significant increase in risk with 1 ACE.

Health conditions

Participants were asked if they had ever been diagnosed by a doctor or nurse with: cancer; type 2 diabetes; coronary heart disease (CHD); respiratory disease[a]; and irritable bowel syndrome (IBS) or other digestive problems

After controlling for demographic confounding, individuals with ≥4 ACEs were significantly more likely to have been diagnosed with each disease type except CHD, compared to those with no ACEs (Table 1; Appendix 2, Table A6)

Table 1: Proportion of adults reporting health conditions and hazard ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	8% of adults reported cancer	**8%** of adults reported Type 2 diabetes	**6%** of adults reported CHD	**16%** of adults reported respiratory disease[a]	**15%** of adults reported IBS or other digestive problems
	HR	HR	HR	HR	HR
1 ACE	0.9	1.1	0.9	1.3*	1.2
2-3 ACEs	1.4	1.3	1.0	1.1	1.4*
≥ 4 ACEs	1.9*	1.8*	1.5	1.9*	2.1**

[a]e.g. chronic bronchitis, emphysema, chronic obstructive pulmonary disease, asthma); CHD = coronary heart disease (including heart attack or stroke); IBS = irritable bowel syndrome; HR = Hazard ratio; *P<0.05, **P<0.001.

#after controlling for demographic confounding.

7. ACEs and resilience

ACEs and childhood resilience resources

A seven item scale was used to measure childhood resilience resources (Box 1). To provide an overall measure of childhood resilience resources, a variable was created showing how many of the seven items participants reported, with those who responded '*yes*' to less than 4 items categorised as having low childhood resilience resources. Participants who did not respond to at least half of the items (n=1) were removed from analysis.

Box 1: Questions used to measure childhood resilience resources

While you were growing up, before the age of 18 years, do you think the following statements described you?

Response options: Yes, No

1	I felt I belonged in my school
2	I had people I looked up to
3	I had friends who would stand by me during difficult times
4	My family would stand by me during difficult times
5	I felt part of the local community in which I lived
6	I regularly engaged in sporting activities
7	I felt safe in the neighbourhood where I grew up

Figure 6. Proportion of adults reporting low childhood resilience resources by ACE count,[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)
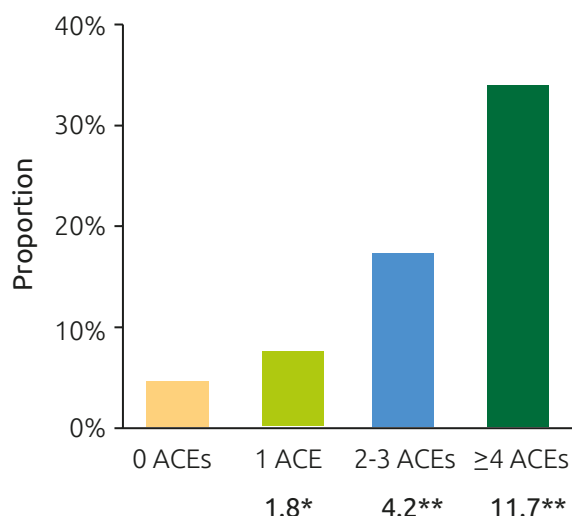
[a]Weighted data; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

One in ten (10.6%) adults reported low childhood resilience resources. Prevalence increased with ACE count, from 4.5% of those with 0 ACEs to 33.8% of those with ≥4 ACEs (Figure 6).[2]

After controlling for demographic confounding, individuals with 1 ACE were 1.8 times more likely to report low childhood resilience, those with 2-3 ACEs were 4.2 times more likely, and those with ≥4 ACEs were 11.7 times more likely (compared with individuals with 0 ACEs; Figure 6, Appendix 2, Table A8).

11%
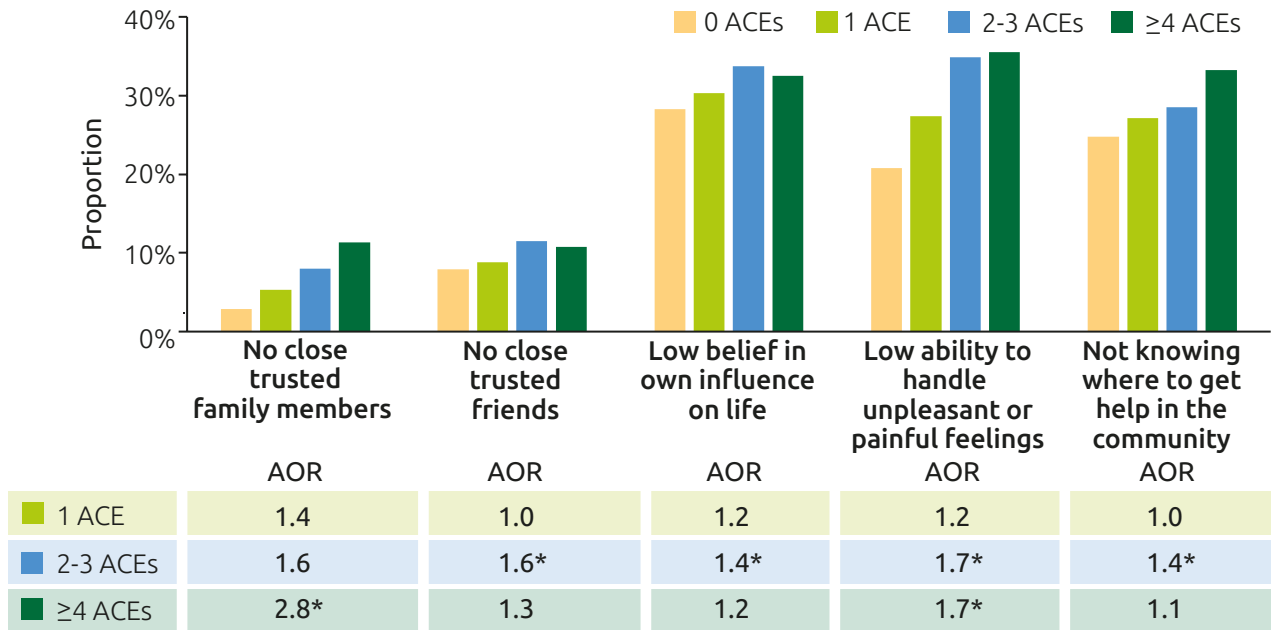of adults reported **low childhood resilience resources**

Those with ≥4 ACEs were **11.7 times** more likely to report low childhood resilience than those with 0 ACEs[#]

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1 The weighted proportion reporting each of the seven childhood resilience resource items by ACE count are shown in Appendix 2, Table A7.

#after controlling for demographic confounding.

ACEs and current resilience resources

Figure 7. Proportion of adults with low current resilience resources by ACE count,[a] and adjusted odds ratios showing increased risk in individuals with ACEs (compared with no ACEs)

	No close trusted family members	No close trusted friends	Low belief in own influence on life	Low ability to handle unpleasant or painful feelings	Not knowing where to get help in the community
	AOR	AOR	AOR	AOR	AOR
1 ACE	1.4	1.0	1.2	1.2	1.0
2-3 ACEs	1.6	1.6*	1.4*	1.7*	1.4*
≥4 ACEs	2.8*	1.3	1.2	1.7*	1.1

[a]Weighted data; AOR = adjusted odds ratio; *P<0.05, **P<0.001.

No close trusted family members

Participants were asked, 'roughly how many close family members do you have that you trust?'

One in 20 (5.2%) adults reported they had no close family members who they trust. Prevalence increased with ACE count, from 2.9% of those with 0 ACEs to 11.3% of those with ≥4 ACEs (Figure 7).

After controlling for demographic confounding, individuals with ≥4 ACEs were 2.8 times more likely to report having no close trusted family members (compared with individuals with 0 ACEs; Appendix 2, Table A9). However, the increases in risk in those with 1 ACE or 2-3 ACEs did not reach significance.

> **5%**
> of adults reported **having no close trusted family members**

> Those with ≥4 ACEs were **2.8 times** more likely to have no close trusted family members than those with 0 ACEs[#]

No close trusted friends

Participants were asked, 'outside of your family, roughly how many close friends do you have that you can trust?'

Under one in ten (9.0%) adults reported they had no close friends who they trust. Prevalence increased from 7.9% of those with 0 ACEs to 11.5% of those with 2-3 ACEs (Figure 7).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.6 times more likely to report having no close trusted friends (compared with individuals with 0 ACEs; Appendix 2, Table A9). The increase in risk in those with ≥4 ACEs did not reach significance.

> **9%**
> of adults reported **having no close trusted friends**

#after controlling for demographic confounding.

Low belief in own influence on life

Participants were asked if they currently felt the statement, 'I believe I can influence what happens in my life', describes them. Those responding 'sometimes' or 'never' were coded as having a low belief in their own influence on their life

> **30%**
> of adults reported
> **low belief in their own influence on their life**

Almost a third (30.2%) of adults reported a low belief in their own influence on their life. Prevalence increased from 28.3% of those with 0 ACEs to 33.7% of those with 2-3 ACEs (Figure 7).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.4 times more likely to report a low belief in their own influence on life (compared with individuals with 0 ACEs; Appendix 2, Table A9). However, there was no significant increase in risk in those with 1 ACE or ≥4 ACEs.

Low ability to handle unpleasant or painful feelings

Participants were asked if they currently felt the statement, 'I am able to handle unpleasant or painful feelings like sadness, fear, and anger', describes them. Those responding 'sometimes' or 'never' were coded as having a low ability to handle unpleasant or painful feelings

> **26%**
> of adults reported
> **low ability to handle unpleasant or painful feelings**

> Those with ≥4 ACEs were
> **1.7 times**
> more likely eport
> low ability to handle unpleasant or painful feelings than those with 0 ACEs#

Over a quarter (26.5%) of adults reported a low ability to handle unpleasant or painful feelings. Prevalence increased with ACE count, from 20.8% of those with 0 ACEs to 35.5% of those with ≥4 ACEs (Figure 7).

After controlling for demographic confounding, individuals with 2-3 ACEs and those ≥4 ACEs with were 1.7 times more likely to report a low ability to handle unpleasant or painful feelings (compared with individuals with 0 ACEs; Appendix 2, Table A9). There was no significant increase in risk in those with 1 ACE.

Not knowing where to get help in the community

Participants were asked, 'currently, do you know where to get help in your community?' Those responding 'no' were coded as not knowing where to get help in the community

> **27%**
> of adults reported
> **not knowing where to get help in the community**

Over a quarter (26.9%) of adults reported that they did not know where to get help in the community. Prevalence increased with ACE count, from 24.8% of those with 0 ACEs to 33.2% of those with ≥4 ACEs (Figure 7).

After controlling for demographic confounding, individuals with 2-3 ACEs were 1.4 times more likely to report not knowing where to get help in the community (compared with individuals with 0 ACEs; Appendix 2, Table A9). However, there was no significant increase in risk in those with 1 ACE or ≥4 ACEs.

9. Discussion

...the more ACEs individuals reported, the more likely they were to report harms including illicit drug use, involvement in violence, and poor mental and physical health ...

The Childhood Adversity and Health and Wellbeing during COVID-19 Study has identified, for the first time, the extent and harmful impacts of ACEs on the Bolton population. The findings provide an understanding of how health and wellbeing in Bolton is affected by ACEs and can support work to prevent ACEs in future generations and develop responses for those affected by them. Over half of residents (51.7%) reported having experienced at least one ACE before the age of 18, with over one in ten (10.8%) reporting four or more ACEs. These levels of ACE exposure are comparable to those from other ACE studies conducted at local and national levels in the UK [11,13,14,16] and in other countries [20–22]. Exposure to ACEs can have life-long effects on health and social wellbeing, and in line with existing evidence [4], this study found cumulative relationships between ACEs and many of the outcomes measured. Thus, the more ACEs individuals reported, the more likely they were to report harms including illicit drug use, involvement in violence, and poor mental and physical health. For example, compared to individuals with no ACEs, those with four or more were nearly three times more likely to report lifetime cannabis use and nearly eight times more likely to report having been a victim of violence in the past year (see Section 4).

Consistent with international evidence [23], exposure to ACEs was a strong predictor of poor mental health (see Section 5). Overall, 16% of adults self-reported current poor mental health and 26% reported having been diagnosed with a mental illness during their lifetime. The prevalence of both outcomes increased sharply with ACE count. Thus, almost a third (31%) of individuals with four or more ACEs reported current poor mental health (vs 11% of those with 0 ACEs) and over half (53%) reported a mental illness diagnosis (0 ACEs, 16%). These strong relationships remained after controlling for deprivation and other participant characteristics. ACEs were also strongly associated with poor sleep and both addiction and anti-depressant use. Exposure to child maltreatment and other forms of toxic stress in childhood can affect childhood brain and physiological development, affecting aspects such as trust and self-esteem and limiting an individual's ability to cope [24,25]. These findings highlight the importance of preventing ACEs and providing effective support and treatment options to those who are affected by them to help improve population mental health and wellbeing.

Preventing ACEs will help to reduce inequality and improve population health. Findings here show that over one in ten adult residents reported poor physical health, with the proportion increasing with ACE count (see Section 6). Individuals with four or more ACEs were also found to be at significantly increased risk of the development of cancer, type 2 diabetes, respiratory disease and IBS or digestive problems. These findings are

Preventing ACEs will help to reduce inequality and improve population health. ...

consistent with those of other UK studies, demonstrating an association between ACEs and the development of chronic disease [5,16]. Such links can emerge through both the increased vulnerability to health-risk behaviours in those who suffer higher ACEs and because of their early life impacts on physiological development. Strong relationships between ACEs and poor health increase disease burden, result in greater demand for health services, and can have broader economic and societal impacts (e.g. work absence). A recent study estimated that the annual financial burden of ACEs, based on disability–adjusted life years lost to 13 health risks and conditions, was £40.6 billion in England [26]. Thus, preventing ACEs has major potential cost savings to the NHS and other support services locally.

...an individual's resilience - their ability to cope - can circumvent the detrimental behavioural and psychological changes associated with ACE exposure ...

Experiencing ACEs is not deterministic of poor outcomes and many individuals who are exposed to ACEs avoid their negative outcomes. Increasingly, research has shown that an individual's resilience - their ability to cope - can circumvent the detrimental behavioural and psychological changes associated with ACE exposure. This study found strong relationships between the resilience resources measured and ACEs, with increased ACE exposure associated with lower levels of resilience (see Section 7). One in ten adults reported low childhood resilience resources, and prevalence increased with ACE count, rising to one in three of those with four or more ACEs. Similar findings were evident for sources of adult resilience. Over a quarter of adults reported a low ability to handle unpleasant or painful feelings, with prevalence increasing from 21% in those with no ACEs to 35% in those with four or more ACEs. It is important to acknowledge that the study was conducted during a period of national COVID-19 restrictions which may have impacted reported levels of current mental and physical health. The limits placed on social interaction may have also impacted individuals' reporting of current resilience resources, for example, knowing where to get help in their local community if restrictions had left individuals feeling socially isolated. The promotion of resilience factors, such as those identified here, can offer some protection against the harmful impacts of ACEs. The findings serve to highlight the importance of developing resilience in populations. In childhood, having secure adult relationships and the promotion of safe and nurturing environments will not only help to prevent ACEs for future generations, but also help lessen the risk of poor health and wellbeing outcomes for individuals exposed to them. Different organisations can all play an important role in the provision of support to individuals exposed to ACEs to help promote resilience.

... In childhood, having secure adult relationships and the promotion of safe and nurturing environments ... help lessen the risk of poor health and wellbeing outcomes for individuals exposed to them.

The findings from this study can enable the development of a shared understanding across agencies as to how ACEs can affect individuals across the life course. However, there a number of limitations which should be recognised when interpreting the study findings (see Appendix for full details). The study sample is under-representative of the ethnic diversity in the region and this could not be adjusted for in our analysis. There was also difficulty in accessing young people to participate in the study. Furthermore, participant responses to outcomes (e.g. mental wellbeing, current resilience resources) may have been influenced by the COVID-19 restrictions which were in place during data collection. However, work to prevent ACEs, responding effectively to individuals who have been affected by them and helping to build their resilience can benefit a range of organisations in Bolton, and help to support the delivery of more effective services.

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Appendix 1. Methodology

The Childhood Adversity and Health and Wellbeing During COVID-19 Study was undertaken between December 2020 and March 2021 by Public Health Wales NHS Trust and Bangor University. DJS Research, a private market research company (MRC), was commissioned to undertake study data collection. All interviews abided by the Market Research Society Code of Conduct [27]. Ethical approval for the study was granted by the Bangor University Healthcare Sciences Ethics and Research Committee (Ref 2020-16844).

Sample selection

A target sample of 2,000 individuals from the general adult population was selected to ensure sufficient numbers within demographic sub-groups and higher ACE count categories for analysis (based on ACE prevalence in other UK studies [26]). To obtain a sample broadly representative of the Bolton population, a stratified sampling approach was used, with stratification by age and deprivation.

Recruitment

Landline and mobile phone numbers for Bolton residents were purchased by the MRC from a reputable commercial sample provider. Telephone calls were made by the MRC to a sample of phone numbers across all days of the week; between the hours of 9am-9pm on weekdays and 10am-4pm on weekends.

Due to difficulties accessing younger age groups via telephone sampling, an online version of the survey was developed by the MRC and sent to a panel of Bolton residents who had opted to take part in paid online research studies. The panel was accessed via a commercial provider. While this method was used to target younger adults, the online sample was extended to include participants from other age groups proportionate to the Bolton population. No changes were made to the survey, consent procedures or information provided to the participant using this methodology. Further targeting of younger participants was undertaken in the community with the support of Bolton Community and Voluntary Services and Bolton College. Here, potential participants were informed of the study by local agencies and provided with a link to the online version should they wish to participate.

The study inclusion criteria were:

- Bolton resident
- Aged 18 years and over
- Cognitively able to participate.

Participation rate

We are unable to calculate a participation rate for the online sample. For the telephone sample, contact was made with 5,773 potential participants, of whom 2.3% (n=132) were ineligible. Of potential eligible participants, 3,902 (69.1%) declined to take part in the study, with 1,658 completing an interview, and 81 individuals agreeing to be interviewed but not meeting age quotas. Thus the overall participation rate was 30.8% of eligible individuals.

Questionnaire

The questionnaire was developed by the research team in collaboration with the Bolton Council Public Health team. It included an established tool to measure exposure to ACEs developed by the United States Centers for Disease Control and Prevention, based on the original ACE questionnaire developed by Felitti et al. 1998 [3]. The questions used to identify exposure to nine ACEs are shown in Table i.

Data was collected on a number of topics relating to health and wellbeing, adverse childhood experiences, and resilience resources, as described in the Methods section of the main report. Table ii outlines the questions and qualifying responses for all outcomes measures included in the survey. Data on participant socio-demographics were also collected, including: age, sex, ethnicity, location of residence, employment, and marital status. Further reports and analyses will examine the relationships between ACEs and the impacts of COVID-19, measures included within the survey but not analysed here.

Interviews were conducted over the telephone or using an online survey. For the telephone survey, the study was verbally described to all potential participants and a web address was provided for further information on the study. Online participants were provided with the same information. It was made clear to all potential participants that participation was voluntary and that they were able to skip or decline any questions, finish the survey without completion and that they did not have to give a reason for doing so, and that a decision to stop would not affect their rights, any current or future health treatment, or any services they receive. Participants provided opt-in consent prior to participation which was recorded within the survey. On completion of the survey, individuals were provided with details for a website containing links to appropriate local/national support services. Telephone participants could also opt for the website to be emailed to them by providing their email address. Participant emails were not stored with their data or accessed by the research team. On average, telephone interviews took 20 minutes to complete.

Table i: ACEs enquired about in the study

ACE	Question All ACE questions were preceded by the statement "While you were growing up, before the age of 18…" *(response options)*	Response indicating ACE
Physical abuse	How often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way? This does not include gentle smacking for punishment. *(never; once; more than once; prefer not to say)*	Once or more than once
Verbal abuse	How often did a parent or adult in your home ever swear at you, insult you, or put you down? *(never; once; more than once; prefer not to say)*	More than once
Sexual abuse	Did an adult or someone at least five years older than you sexually abuse you by touching you or making you undertake any sexual activity with them? *(yes; no; prefer not to say)*	Yes
Parental separation	Were your parents ever separated or divorced? *(yes; no; prefer not to say)*	Yes
Domestic violence	How often did your parents or adults in your home ever slap, hit, kick, punch, or beat each other up? *(never; once; more than once; prefer not to say)*	Once or more than once
Mental illness	Did you live with anyone who was depressed, mentally ill or suicidal? *(yes; no; prefer not to say)*	Yes
Alcohol abuse	Did you live with anyone who was a problem drinker or alcoholic? *(yes; no; prefer not to say)*	Yes
Drug abuse	Did you live with anyone who used illegal street drugs or abused prescription medications? *(yes; no; prefer not to say)*	Yes
Incarceration	Did you live with anyone who served time or was sentenced to serve time in a prison or young offenders' institution? *(yes; no; prefer not to say)*	Yes

Table ii: Questions and qualifying responses for outcome measures

	Question *(response options)*	Qualifying response
Health-harming behaviours		
Binge drinking	Currently, on how many days a week do you drink five or more alcoholic drinks in one day (e.g. glasses of wine, beers, shots of spirits)? *(0-7)*	1-7 days
Cigarette use	Have you ever used cigarettes? *(never used; used but not in the last 12 months; used in the last 12 months)*	Used in the last 12 months
E-cigarette use	Have you ever used e-cigarettes? *(never used; used but not in the last 12 months; used in the last 12 months)*	Used in the last 12 months
Cannabis use	Have you ever used cannabis? *(never used; used but not in the last 12 months; used in the last 12 months)*	Used but not in the last 12 months, used in the last 12 months
Other street drug use	Have you ever used other street drugs such as cocaine? *(never used; used but not in the last 12 months; used in the last 12 months)*	Used but not in the last 12 months, used in the last 12 months
Physical inactivity	Currently, on how many days a week do you do at least 30 minutes physical activity (enough to make you out of breath)? *(0-7)*	0 days
Violence victimisation	In the last 12 months have you been hit by an adult? *(yes; no; prefer not to say)*	Yes
Violence perpetration	In the last 12 months have you hit another adult for any reason, including to defend yourself? *(yes; no; prefer not to say)*	Yes
Mental health and wellbeing		
Poor mental health	Using a scale of 0 to 10 where 0 is 'extremely poor' and 10 is 'extremely good', how do you rate your mental health now? *(0-10)*	0-4
Mental illness diagnosis	Have you ever been told by a doctor or nurse that you have a mental illness, including depression and anxiety? (*yes; no; prefer not to say*)	Yes
Addiction diagnosis	Have you ever been told by a doctor or nurse that you have an addiction to alcohol or any type of illegal drug or prescribed medication? (*yes; no; prefer not to say*)	Yes
Anti-depressant use	Have you ever used anti-depressants or other mood medication? *(never used; used but not in the last 12 months; used in the last 12 months)*	Used but not in the last 12 months, used in the last 12 months
Poor sleep	Using a scale of 0 to 10 where 0 is 'extremely poor' and 10 is 'extremely good', how well are you sleeping now? *(0-10)*	0-4
Physical health		
Poor physical health	Using a scale of 0 to 10 where 0 is 'extremely poor' and 10 is 'extremely good', how healthy would you say your body feels now? *(0-10)*	0-4
Chronic diseases	Have you ever been told by a doctor or nurse that you have the following conditions, and if so, how old were you when you were first diagnosed? Cancer; type 2 diabetes; heart disease (coronary heart disease, heart attack or stroke); respiratory disease (chronic bronchitis, emphysema, chronic obstructive pulmonary disease, asthma) (*no; yes; prefer not to say*)	Yes to the condition

Resilience			
Low childhood resilience resources	While you were growing up, before the age of 18 years, do you think the following statements described you? …I felt I belonged in my school; I had people I looked up to; I had friends who would stand by me during difficult times; My family would stand by me during difficult times; I felt part of the local community in which I lived; I regularly engaged in sporting activities; I felt safe in the neighbourhood where I grew up (yes, no)	Yes to <4 items	
No close trusted family members	Roughly how many close family members do you have that you trust? (none; 1; 2-5; 6-10; 11-20; 21-30; over 30)	None	
No close trusted friends	Outside of your family, roughly how many close friends do you have that you can trust? (none; 1; 2-5; 6-10; 11-20; 21-30; over 30)	None	
Low belief in own influence on life	Currently, do you think these statements describe you? …I believe I can influence what happens in my life (never; sometimes; most of the time)	Sometimes or never	
Low ability to handle unpleasant or painful feelings	Currently, do you think these statements describe you? …I am able to handle unpleasant or painful feelings like sadness, fear, and anger (never; sometimes; most of the time)	Sometimes or never	
Not knowing where to get help in the community	Currently, do you know where to get help in your community? (no; yes)	No	

Sample characteristics

Table iii shows the demographics of participants in the sample in comparison to the Bolton population. The sample varied from Bolton population demographics by sex, age and deprivation, with more females and individuals from less deprived areas, and fewer individuals in younger age groups (e.g. <30 years old) participating.

Table iii: Demographics of the sample and comparison with the Bolton population* (aged 18+ years)

		Bolton sample (N=1,876)		Bolton population (aged 18+; N=219,165)			
		n	%	n	%	^{2}	p
Sex	Male	738	39.3	107,722	49.2		
	Female	1,138	60.7	111,443	50.8	71.658	<0.001
Age group	18-29	161	8.6	41,498	18.9		
	30-39	186	9.9	38,105	17.4		
	40-49	334	17.8	36,175	16.5		
	50-59	377	20.1	38,312	17.5		
	60-69	356	19.0	29,094	13.3		
	70+	462	24.6	35,981	16.4	296.308	<0.001
Deprivation quintile	1 (most deprived)	734	39.1	93,450	42.6		
	2	319	17.0	36,109	16.5		
	3	230	12.3	28,306	12.9		
	4	298	15.9	32,328	14.8		
	5 (least deprived)	295	15.7	28,972	13.2	16.764	0.002

*LSOA population estimates mid-2019 [28]

Calculation of ACE count

To measure exposure to ACEs before the age of 18, questions covering 9 ACEs were included in the questionnaire (see Table i). Responses to these questions were then scored to calculate a person's ACE count (range 0 to 9) - the number of different types of ACEs they experienced. The ACE score was then classified into four ACE count categories (unweighted data):

- No ACEs (n = 956)
- One ACE (n = 429)
- Two or three ACEs (n = 324)
- Four or more ACEs (n = 167)

Counting and categorising ACEs is a standard approach used in ACE studies internationally. While it provides a measure of the extent of an individual's exposure to ACEs, it is recognised that the method does not take into account the timing, duration or frequency of exposure to each ACE, nor any differential impacts of specific ACE types or combinations.

Data analysis

The MRC provided the research team with an anonymised data file. Data cleaning and analysis was undertaken using IBM SPSS Statistics v25. Due to missing data across key variables (age, sex) or where individuals were unable to be categorised an ACE count, data for 19 respondents was excluded from analysis.

Estimates of the prevalence of ACEs in Bolton and the proportions of adults reporting each outcome overall and by ACE count level use data weighted to Bolton mid-2019 population estimates by sex, age group and deprivation quintile (Index of Multiple Deprivation [IMD]). Independent relationships between ACEs and outcome measurements, controlling for participants' socio-demographics and survey method, use unweighted data and logistic regression analysis. Analyses between ACEs and the risk of health conditions (see Section 6) use unweighted data and survival analysis (cox regression), adjusting for socio-demographics and survey method (telephone or online). It should be noted that that findings here are associations and do not imply causation.

Limitations

There are a number of limitations that should be considered when interpreting the study findings. Participation in the study was voluntary and therefore it is not possible to identify or exclude any bias created by refusal to participate. All study data were self-reported and subject to subjectivity and accurate reporting. In addition, childhood resilience and ACE measures were retrospective and therefore may be subject to recall capacity and willingness to disclose childhood adversities. However, the ACE prevalence identified in this study is similar to prevalence from other regional and national studies in the UK [11,14,16]. This is a cross-sectional study and consequently causality between outcomes cannot be established.

Differences exist between the demographics of the sample and those of the Bolton population, including an under-representation of males, younger age groups and those residing in more deprived areas (see Sample characteristics: Table iii). However, analyses adjusted for these demographic factors. The study sample was also under-representative of the ethnic diversity in the region and this could not be adjusted for in our analysis due to availability of data at the local level. There were difficulties recruiting those in younger age groups to participate in the telephone survey which resulted in the use of an online panel and targeted recruitment with younger age groups at the local level (see Recruitment above). However, survey method was included as a covariate in the analysis. Finally, all data were collected during a period of COVID-19 'lockdown' restrictions in the UK, which placed limitations on social interaction and activities. These restrictions may have affected the reported levels of mental and physical health and current resilience resources identified in the study.

Appendix 2. Data tables

Table A1: Bivariate relationship between participant demographics, individual ACEs and ACE Count

| | | Individual ACEs | | | | | | | | | ACE count (9 ACEs) | | | |
| | | Child abuse | | | | Household dysfunction | | | | | | | | |
		Parental separation	Verbal	Physical	Sexual	Mental illness	Domestic violence	Alcohol abuse	Incarceration	Drug abuse	0	1	2-3	≥4
Prevalence %		20.0	20.7	15.5	8.4	14.0	14.7	11.0	3.2	3.1	51.0	22.9	17.3	8.9
n (total sample size)		1869	1857	1861	1845	1873	1855	1870	1873	1872				1876
Sex	Male	17.1	21.9	16.9	4.5	11.1	14.7	10.5	2.8	2.4	53.3	22.4	16.0	8.4
	Female	21.8	19.9	14.5	10.9	15.9	14.7	11.3	3.4	3.5	49.5	23.2	18.1	9.2
	X²	6.006	1.025	1.978	23.380	8.557	0.000	0.312	0.491	1.721				2.893
	p	0.014	0.311	0.160	<0.001	0.003	0.996	0.577	0.483	0.190				0.408
Age group	18-29	36.7	25.8	11.5	7.9	24.2	13.2	12.0	5.0	7.0	39.1	28.0	19.3	13.7
	30-39	32.6	29.2	19.6	7.3	18.4	15.5	13.0	4.3	5.4	44.6	19.9	21.0	14.5
	40-49	27.9	22.7	17.6	10.0	18.0	19.4	15.6	4.2	4.5	42.2	22.5	24.6	10.8
	50-59	21.8	22.8	20.2	10.5	15.4	18.4	13.8	4.5	4.5	45.6	23.1	19.4	11.9
	60-69	12.6	18.5	14.2	9.9	11.0	13.5	9.3	2.8	0.6	56.5	23.0	13.5	7.0
	70+	7.6	14.0	10.9	5.0	7.2	9.3	5.4	0.6	0.6	64.1	22.3	11.0	2.6
	X²	116.249	26.158	19.643	11.457	42.543	21.141	27.134	15.492	32.652				97.681
	p	<0.001	<0.001	0.001	0.043	<0.001	0.001	<0.001	0.008	<0.001				<0.001
Deprivation quintile	1 (most deprived)	24.2	23.3	16.1	9.9	15.8	18.1	13.0	4.5	4.0	46.7	23.8	18.0	11.4
	2	21.0	18.7	16.1	10.2	14.2	12.4	13.5	2.8	3.8	47.0	24.8	21.0	7.2
	3	19.6	21.1	15.3	11.4	15.7	13.5	10.4	3.0	2.6	49.6	25.2	16.1	9.1
	4	15.4	20.3	14.6	5.5	14.1	13.4	10.8	2.3	2.7	55.0	20.8	15.8	8.4
	5 (least deprived)	13.2	16.3	14.2	3.4	8.1	10.9	3.7	1.4	1.0	62.7	18.6	13.9	4.7
	X²	20.662	7.306	0.869	18.811	10.959	11.838	21.172	8.169	6.902				34.305
	p	<0.001	0.121	0.929	0.001	0.027	0.019	<0.001	0.086	0.141				0.001
Ethnicity	White	20.3	20.6	16.0	8.8	14.2	14.7	11.6	3.3	3.3	50.0	23.2	17.6	9.1
	Other	17.1	20.9	11.3	5.1	13.2	14.4	6.4	2.3	1.8	58.2	20.0	14.5	7.3
	X²	1.222	0.009	3.157	3.345	0.153	0.018	5.212	0.677	1.312				5.262
	p	0.269	0.923	0.076	0.067	0.696	0.893	0.022	0.410	0.252				0.154
Adjusted ACE prevalence		23.4	23.3	16.3	7.9	15.6	15.7	11.9	3.8	4.1	48.3	23.2	17.7	10.8

Table A2: Adjusted odds ratios for health-harming behaviours in demographic and ACE count groups

	Current binge drinking			Past year cigarette use			Lifetime cannabis use			Lifetime other street drug use			Physical inactivity		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Sex															
Male	1.832	1.462-2.297	<0.001	1.250	0.964-1.622	0.092	2.491	1.734-3.579	<0.001	3.278	1.836-5.850	<0.001	0.876	0.706-1.087	0.228
Age group															
18-29	1.900	1.130-3.193	0.015	3.198	1.881-5.439	<0.001	11.264	4.687-27.070	<0.001	2.907	1.027-8.229	0.044	0.382	0.234-0.625	<0.001
30-39	2.363	1.480-3.773	<0.001	3.995	2.479-6.439	<0.001	21.327	9.473-48.015	<0.001	6.778	2.756-16.668	<0.001	0.561	0.370-0.851	0.007
40-49	3.344	2.301-4.860	<0.001	2.050	1.330-3.160	0.001	6.468	2.903-14.415	<0.001	2.828	1.185-6.748	0.019	0.488	0.347-0.687	<0.001
50-59	3.114	2.182-4.444	<0.001	1.614	1.048-2.484	0.030	3.859	1.698-8.771	0.001	Ref*		<0.001	0.654	0.479-0.893	0.007
60-69	2.136	1.484-3.076	<0.001	1.672	1.090-2.564	0.019	2.427	1.010-5.832	0.047	0.285	0.059-1.369	0.117	0.696	0.511-0.947	0.021
70+	Ref		<0.001	Ref		<0.001	Ref		<0.001	0.000	-	0.992	Ref		<0.001
Deprivation quintile															
1 (most deprived)	0.789	0.566-1.102	0.164	3.672	2.274-5.929	<0.001	1.104	0.623-1.959	0.734	0.938	0.373-2.359	0.892	2.022	1.446-2.826	<0.001
2	0.932	0.637-1.363	0.717	2.568	1.513-4.356	<0.001	1.296	0.693-2.425	0.416	0.504	0.163-1.565	0.236	1.650	1.125-2.420	0.010
3	0.897	0.596-1.351	0.604	1.575	0.865-2.868	0.138	1.118	0.552-2.264	0.758	1.518	0.529-4.358	0.438	1.193	0.780-1.826	0.415
4	1.048	0.717-1.533	0.808	1.395	0.782-2.488	0.260	0.677	0.323-1.418	0.301	0.839	0.263-2.682	0.768	1.138	0.764-1.695	0.523
5 (least deprived)	Ref		0.454	Ref		<0.001	Ref		0.453	Ref		0.364	Ref		<0.001
Ethnicity															
White	4.265	2.603-6.990	<0.001	2.286	1.468-3.558	<0.001	3.303	1.775-6.147	<0.001	3.556	1.314-9.621	0.012	1.105	0.759-1.608	0.603
ACE count															
0	Ref		0.102	Ref		0.042	Ref		0.001	Ref		<0.001	Ref		0.082
1	1.390	1.053-1.835	0.020	1.010	0.726-1.407	0.951	1.254	0.772-2.035	0.361	2.804	1.156-6.804	0.023	0.990	0.757-1.294	0.940
2-3	1.172	0.859-1.598	0.316	1.372	0.975-1.931	0.070	1.897	1.184-3.039	0.008	4.763	2.067-10.972	<0.001	1.327	0.993-1.774	0.056
≥4	1.343	0.912-1.978	0.135	1.665	1.101-2.518	0.016	2.679	1.575-4.558	<0.001	5.860	2.398-14.318	<0.001	1.433	0.985-2.085	0.060
Survey type															
Telephone	0.533	0.382-0.742	<0.001	1.137	0.770-1.679	0.517	0.698	0.441-1.104	0.125	0.387	0.204-0.736	0.004	1.044	0.738-1.477	0.808

*Reference category changed to the 50-59 year age group due to no positive cases in the 70+ age group. AOR= Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A2A: Adjusted odds ratios for cigarette and e-cigarette use in demographic and ACE count groups

	Past year cigarette and e-cigarette use		
	AOR	95% CIs	P
Sex			
Male	1.104	0.869-1.403	0.418
Age group			
18-29	3.470	2.127-5.662	<0.001
30-39	4.364	2.801-6.799	<0.001
40-49	2.243	1.514-3.322	<0.001
50-59	1.773	1.202-2.615	0.004
60-69	1.654	1.119-2.445	0.012
70+	Ref		<0.001
Deprivation quintile			
1 (most deprived)	3.462	2.280-5.257	<0.001
2	2.474	1.558-3.928	<0.001
3	1.384	0.815-2.351	0.229
4	1.276	0.768-2.120	0.346
5 (least deprived)	Ref		<0.001
Ethnicity			
White	2.548	1.693-3.834	<0.001
ACE count			
0	Ref		0.075
1	1.067	0.792-1.438	0.671
2-3	1.417	1.036-1.938	0.029
≥4	1.460	0.985-2.163	0.060
Survey type			
Telephone	0.987	0.694-1.404	0.942

AOR= Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A3: Adjusted odds ratios for past year violence involvement in demographic and ACE count groups

	Violence victimisation			Violence perpetration		
	AOR	95% CIs	P	AOR	95% CIs	P
Sex						
Male	1.420	0.836-2.414	0.195	1.851	0.965-3.550	0.064
Age group						
18-29	9.757	2.640-36.069	0.001	9.485	1.925-46.740	0.006
30-39	8.614	2.389-31.065	0.001	6.008	1.182-30.529	0.031
40-49	3.508	0.962-12.796	0.057	5.873	1.259-27.401	0.024
50-59	2.701	0.724-10.078	0.139	2.267	0.429-11.985	0.335
60-69	0.994	0.197-5.019	0.994	0.514	0.046-5.746	0.589
70+	Ref		<0.001	Ref		0.007
Deprivation quintile						
1 (most deprived)	1.494	0.552-4.043	0.430	1.096	0.350-3.435	0.875
2	1.607	0.545-4.733	0.390	1.187	0.337-4.179	0.790
3	1.207	0.358-4.077	0.762	0.667	0.140-3.177	0.611
4	0.924	0.268-3.193	0.901	1.287	0.343-4.829	0.709
5 (least deprived)	Ref		0.760	Ref		0.923
Ethnicity						
White	1.289	0.635-2.617	0.482	1.407	0.589-3.363	0.442
ACE count						
0	Ref		<0.001	Ref		0.015
1	1.964	0.857-4.501	0.110	2.178	0.857-5.533	0.102
2-3	4.482	2.123-9.462	<0.001	2.699	1.069-6.816	0.036
≥4	7.874	3.633-17.065	<0.001	4.748	1.833-12.296	0.001
Survey type						
Telephone	0.356	0.201-0.629	<0.001	0.273	0.136-0.549	<0.001

AOR= Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A4: Adjusted odds ratios for mental health and wellbeing outcomes in demographic and ACE count groups

	Current poor mental health			Lifetime mental illness diagnosis			Lifetime addiction diagnosis			Lifetime anti-depressant use			Current poor sleep		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Sex															
Male	0.699	0.513-0.953	0.023	0.557	0.439-0.708	<0.001	2.259	1.146-4.454	0.019	0.497	0.388-0.638	<0.001	0.696	0.547-0.887	0.003
Age group															
18-29	8.407	4.336-16.302	<0.001	1.960	1.191-3.227	0.008	0.529	0.113-2.477	0.419	1.287	0.765-2.165	0.341	1.485	0.913-2.414	0.111
30-39	5.160	2.677-9.948	<0.001	2.310	1.483-3.599	<0.001	0.469	0.106-2.080	0.319	1.868	1.188-2.938	0.007	1.164	0.732-1.852	0.521
40-49	4.522	2.462-8.305	<0.001	2.436	1.688-3.515	<0.001	1.121	0.383-3.285	0.835	1.783	1.221-2.606	0.003	1.340	0.916-1.960	0.132
50-59	4.067	2.228-7.422	<0.001	1.717	1.197-2.463	0.003	1.408	0.511-3.878	0.508	1.754	1.219-2.525	0.002	1.381	0.961-1.984	0.081
60-69	2.172	1.131-4.171	0.020	1.690	1.175-2.430	0.005	0.566	0.158-2.030	0.382	1.568	1.080-2.275	0.018	1.352	0.937-1.952	0.107
70+	Ref		<0.001	Ref		<0.001	Ref		0.438	Ref		0.016	Ref		0.440
Deprivation quintile															
1 (most deprived)	2.335	1.365-3.995	0.002	2.576	1.757-3.778	<0.001	5.421	1.239-23.709	0.025	2.249	1.530-3.305	<0.001	1.858	1.275-2.707	0.001
2	1.857	1.024-3.367	0.041	1.892	1.229-2.912	0.004	1.926	0.343-10.822	0.457	1.729	1.120-2.670	0.013	1.360	0.882-2.096	0.164
3	1.309	0.671-2.554	0.430	2.106	1.338-3.316	0.001	3.429	0.646-18.194	0.148	2.018	1.279-3.183	0.003	1.406	0.885-2.232	0.149
4	1.625	0.871-3.032	0.127	1.300	0.826-2.047	0.257	0.503	0.045-5.641	0.577	0.973	0.606-1.563	0.910	1.120	0.713-1.757	0.623
5 (least deprived)	Ref		0.011	Ref		<0.001	Ref		0.018	Ref		<0.001	Ref		0.004
Ethnicity															
White	1.041	0.685-1.580	0.852	2.730	1.786-4.173	<0.001	2.081	0.579-7.473	0.261	2.279	1.481-3.509	<0.001	1.456	0.975-2.173	0.066
ACE count															
0	Ref		<0.001	Ref		<0.001	Ref		0.004	Ref		<0.001	Ref		<0.001
1	1.051	0.712-1.551	0.801	1.362	1.020-1.818	0.036	1.468	0.534-4.035	0.456	1.423	1.060-1.910	0.019	1.141	0.847-1.537	0.386
2-3	1.746	1.197-2.545	0.004	2.679	1.996-3.596	<0.001	3.340	1.325-8.422	0.011	2.474	1.828-3.348	<0.001	1.834	1.352-2.489	<0.001
≥4	2.321	1.499-3.593	<0.001	4.236	2.926-6.131	<0.001	5.258	1.969-14.043	0.001	3.031	2.082-4.413	<0.001	2.372	1.629-3.455	<0.001
Survey type															
Telephone	0.555	0.384-0.804	0.002	1.146	0.797-1.647	0.462	0.315	0.139-0.713	0.006	0.629	0.445-0.889	0.009	0.499	0.360-0.693	<0.001

AOR=Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A5: Adjusted odds ratios for poor physical health in demographic and ACE count groups

	Current poor physical health		
	AOR	95% CIs	P
Sex			
Male	0.788	0.594-1.046	0.099
Age group			
18-29	2.476	1.402-4.375	0.002
30-39	1.854	1.067-3.220	0.028
40-49	2.069	1.294-3.308	0.002
50-59	1.846	1.162-2.932	0.009
60-69	1.786	1.116-2.861	0.016
70+	Ref		0.029
Deprivation quintile			
1 (most deprived)	1.893	1.212-2.958	0.005
2	1.316	0.787-2.202	0.296
3	1.265	0.727-2.202	0.405
4	0.763	0.427-1.362	0.360
5 (least deprived)	Ref		0.001
Ethnicity			
White	1.143	0.746-1.749	0.540
ACE count			
0	Ref		<0.001
1	1.082	0.757-1.546	0.664
2-3	1.724	1.208-2.460	0.003
≥4	2.485	1.636-3.772	<0.001
Survey type			
Telephone	0.720	0.493-1.050	0.088

AOR = Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A6: Modelled changes in risk of disease development with ACEs counts using Cox regression survival analysis

| | n | P[a] | ACE count (reference category 0 ACEs) | | | | | | | | |
| | | | 1 ACE | | | 2-3 ACEs | | | ≥4 ACEs | | |
			HR	95% CIs	P	HR	95% CIs	P	HR	95% CIs	P
Cancer	1861	0.023	0.879	0.605-1.276	0.497	1.374	0.928-2.032	0.112	1.861	1.135-3.053	0.014
Type 2 diabetes	1854	0.133	1.111	0.778-1.586	0.562	1.299	0.864-1.952	0.208	1.797	1.073-3.009	0.026
CHD	1859	0.673	0.945	0.612-1.459	0.798	0.954	0.562-1.619	0.861	1.473	0.748-2.902	0.263
Respiratory disease	1862	0.005	1.342	1.021-1.766	0.035	1.148	0.826-1.596	0.410	1.876	1.296-2.715	0.001
IBS or digestive problems	1859	<0.001	1.154	0.867-1.537	0.326	1.439	1.063-1.948	0.018	2.138	1.509-3.029	<0.001

[a]The overall significance of association between the outcome measure and ACE counts. HR = Hazard ratio; CIs = 95% confidence intervals.

Table A7: Weighted proportion reporting each childhood resilience resource by ACE count

	All	0 ACEs	1 ACE	2-3 ACEs	4+ ACEs
I felt I belonged in my school	75.5	85.5	78.9	60.5	47.8
I had people I looked up to	87.7	91.7	89.4	82.5	75.0
I had friends who would stand by me during difficult times	87.3	92.4	87.8	81.6	72.9
My family would stand by me during difficult times	91.0	96.5	94.9	88.3	62.6
I felt part of the local community in which I lived	80.8	89.8	83.9	72.0	48.3
I regularly engaged in sporting activities	69.7	75.2	68.7	61.0	62.1
I felt safe in the neighbourhood where I grew up	90.0	95.7	94.2	82.2	69.0

Table A8: Adjusted odds ratios for low childhood resilience in demographic and ACE count groups

	Low childhood resilience		
	AOR	95% CIs	P
Sex			
Male	0.896	0.628-1.279	0.544
Age group			
18-29	1.146	0.565-2.327	0.706
30-39	0.674	0.326-1.393	0.287
40-49	1.096	0.605-1.987	0.762
50-59	1.309	0.743-2.308	0.351
60-69	1.135	0.621-2.073	0.682
70+	Ref		0.497
Deprivation quintile			
1 (most deprived)	2.191	1.161-4.134	0.015
2	2.061	1.025-4.147	0.043
3	1.536	0.712-3.317	0.274
4	1.148	0.534-2.470	0.724
5 (least deprived)	Ref		0.039
Ethnicity			
White	0.965	0.558-1.668	0.897
ACE count			
0	Ref		<0.001
1	1.759	1.058-2.925	0.030
2-3	4.219	2.640-6.740	<0.001
≥4	11.681	7.134-19.127	<0.001
Survey type			
Telephone	0.277	0.181-0.424	<0.001

AOR= Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

Table A9: Adjusted odds ratios for current resilience outcomes in demographic and ACE count groups

	No close trusted family members			No close trusted friends			Low belief in own influence on life			Low ability to handle unpleasant or painful feelings			Not knowing where to get help in the community		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Sex															
Male	1.076	0.677-1.709	0.758	1.563	1.128-2.166	0.007	1.075	0.865-1.336	0.513	0.683	0.535-0.871	0.002	1.318	1.060-1.640	0.013
Age group															
18-29	1.134	0.456-2.817	0.787	0.517	0.251-1.064	0.073	0.978	0.626-1.530	0.923	2.363	1.497-3.731	<0.001	1.068	0.691-1.651	0.767
30-39	0.641	0.241-1.703	0.372	0.496	0.247-0.996	0.049	0.812	0.531-1.240	0.335	1.408	0.908-2.184	0.126	0.838	0.554-1.269	0.404
40-49	0.840	0.376-1.877	0.671	0.582	0.334-1.012	0.055	0.757	0.532-1.076	0.120	1.158	0.794-1.691	0.446	0.651	0.459-0.923	0.016
50-59	0.925	0.425-2.015	0.845	0.934	0.575-1.515	0.781	1.069	0.774-1.477	0.685	1.207	0.839-1.737	0.310	0.579	0.413-0.810	0.001
60-69	1.557	0.760-3.192	0.226	0.996	0.615-1.613	0.989	0.936	0.674-1.301	0.695	0.746	0.501-1.112	0.151	0.686	0.494-0.951	0.024
70+	Ref		0.402	Ref		0.142	Ref		0.450	Ref		<0.001	Ref		0.005
Deprivation quintile															
1 (most deprived)	2.200	0.958-5.054	0.063	1.729	1.042-2.871	0.034	2.161	1.530-3.053	<0.001	2.263	1.524-3.359	<0.001	1.374	0.972-1.941	0.072
2	1.845	0.730-4.664	0.196	1.056	0.572-1.950	0.861	1.605	1.082-2.380	0.019	2.004	1.290-3.112	0.002	1.359	0.918-2.011	0.126
3	1.827	0.685-4.870	0.228	1.249	0.658-2.371	0.496	1.386	0.900-2.133	0.138	1.479	0.906-2.415	0.118	1.149	0.744-1.775	0.531
4	0.495	0.142-1.725	0.269	0.615	0.306-1.234	0.171	1.069	0.704-1.621	0.755	0.963	0.588-1.577	0.880	1.606	1.088-2.372	0.017
5 (least deprived)	Ref		0.037	Ref		0.004	Ref		<0.001	Ref		<0.001	Ref		0.157
Ethnicity															
White	0.653	0.334-1.275	0.212	0.712	0.422-1.203	0.204	0.790	0.559-1.118	0.184	0.731	0.512-1.042	0.083	1.193	0.823-1.731	0.351
ACE count															
0	Ref		0.026	Ref		0.177	Ref		0.176	Ref		0.004	Ref		0.188
1	1.399	0.780-2.511	0.260	1.042	0.684-1.589	0.847	1.158	0.886-1.512	0.282	1.238	0.922-1.661	0.155	1.045	0.794-1.373	0.755
2-3	1.561	0.824-2.959	0.172	1.593	1.036-2.452	0.034	1.383	1.033-1.852	0.030	1.666	1.219-2.276	0.001	1.383	1.029-1.858	0.031
≥4	2.805	1.437-5.476	0.003	1.287	0.721-2.298	0.394	1.179	0.800-1.737	0.406	1.676	1.128-2.491	0.011	1.127	0.756-1.678	0.558
Survey type															
Telephone	0.340	0.196-0.589	<0.001	0.432	0.278-0.673	<0.001	0.219	0.160-0.298	<0.001	0.337	0.245-0.463	<0.001	0.409	0.300-0.558	<0.001

AOR= Adjusted Odds Ratio; 95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for sex, ethnicity and survey type are female, other ethnicity and online sample respectively.

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