Adverse childhood experiences and engagement with healthcare services

Findings from a survey of adults in Wales and England

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1. Background

There is substantial evidence that our childhood experiences influence our health, wellbeing and behaviours in later life. Exposure to adverse childhood experiences (ACEs; such as child maltreatment or growing up in a household with substance misuse) is associated with increased risks for health-harming behaviours (e.g. smoking) and negative physical and mental health outcomes [1]. In England and Wales, the annual financial burden of ACEs across a range of health risks (e.g. smoking) and causes of ill health (e.g. cancer) has been estimated to total £42.8 billion [2]. Studies have also identified relationships between ACEs and increased use of health services (e.g. high general practitioner (GP) use, having visited an emergency department in the last year [3–5]). Evidence from outside of the UK also demonstrates links between ACE exposure and increased use of prescription drugs [6–9] and lower engagement in preventative healthcare (i.e. services to identify health issues before the development of symptoms), such as cancer screening [10, 11]. Furthermore, in the UK, ACEs have been associated with COVID-19 vaccination hesitancy [12, 13]. However, the associations between ACEs and engagement with healthcare remains relatively underexplored, particularly within the UK.

The experience of child maltreatment is associated with higher levels of distrust of others [14]. Equally, research has identified that individuals who were exposed to multiple ACEs are at increased risk of perceiving public services to be less supportive [15] and hold less trust in medical professionals and public services [16, 17]. Individuals exposed to multiple ACEs have also been found to report less trust in NHS COVID-19 information [12, 13]. However, few studies have explored the potential links between exposure to ACEs and relationships with healthcare providers or comfort in using healthcare settings. A better understanding of how ACEs may be associated with healthcare engagement and relationships with healthcare providers can help tailor support for individuals who have experienced childhood adversity. Moreover, such knowledge can be used to inform the delivery of health services to better support those with ACEs. To add to the evidence base around ACEs and their relationship with health service engagement, this pilot study explores relationships between ACEs and:

- medication use
- engagement with preventative healthcare
- relationships with healthcare professionals, including comfort in using healthcare settings.

Such data are critical to understand the health needs of the population and for the development of appropriate responses.

2. Methods

Between 2nd and 23rd March 2022, 1,832 adults resident in Wales and England completed an online questionnaire about their exposure to ACEs during childhood and their use of health services. Participants were recruited from an online panel provider (Prolific; link opens in a new window). The study was open to a representative sample (stratified by age, sex and ethnicity) of registered panel members aged 18 years and over residing in Wales and England. Appendix 1 details the full study methodology and the demographic breakdown of participants. Sixty-four individuals who failed attention checks, gave inconsistent or duplicate responses or only partially completed the survey, had their responses removed. For the purpose of this report, data were also excluded for individuals who were missing demographic data, or who could not be allocated an ACE count (the number of ACEs reported in childhood, n=72 see Section 2.2). Thus, a final sample of 1,696 participants was used for analyses.

2.1 Study questionnaire

The study questionnaire was developed by the research team and survey questions included: participant demographics (age, gender, ethnicity, postcode and country of residence); exposure to nine types of ACE (measured using an established tool [18]; see Appendix 1); medication use (use of antibiotics in the last year, current prescription medicines and medication adherence); preventative healthcare (childhood vaccines and having health insurance when travelling abroad); relationships and experience with healthcare professionals (perceptions that professionals care about and understand their health and problems, and childhood experience with health and social services); and comfort in using healthcare settings. All measures were self-reported. Appendix 1 details the full questions for data analysed in this study.

2.2 Data analysis

Corresponding with international literature [19], analyses explored ACEs using a count variable that categorised participants based on the number of ACEs they reported having experienced before the age of 18 years (0, 1, 2 to 3, 4 or more). Postcode of residence was converted to Lower Super Output Area (LSOAs; geographical areas with approximately 1,600 residents) for categorisation to the respective English and Welsh Index of Multiple Deprivation (IMD) quintiles [20, 21]. Where individuals provided only partial postcodes, these were allocated the average IMD for the LSOAs that could have contained the partial postcode. The IMD is a standardised measure for comparing deprivation between small localities. However, differences exist between the English and Welsh indices. Due to small numbers in minority ethnic populations, ethnicity was coded into white and all other ethnic groups combined, termed here 'other than white'. Participants were asked to self-disclose their gender (male, female, other [please specify]); due to small numbers in those identifying as 'other', analysis for gender was limited to male or female.

As this pilot study used data for both Welsh and English residents, prevalence data for outcomes are not weighted and thus, prevalence of ACEs and study outcomes are presented for the full final sample. Bivariate analyses (chi-squared) were used to

examine relationships between outcomes, participant demographics and ACE count. Independent relationships between ACEs and all outcomes of interest were then explored using logistic regression analysis, controlling for socio-demographics (age, gender, ethnicity, IMD quintile and country of residence). Analysis used SPSS version 29.

2.3 Presentation of findings

Section 3 details the sample demographics and ACE prevalence (across ACE count and individual ACEs). Subsequent sections explore the following topics and their association with ACEs: medication use (Section 4), preventative healthcare (Section 5), relationships with healthcare professionals and systems (Section 6), and comfort in using healthcare settings (Section 7).

3. Sample demographics

Table 1 shows the sample demographics. Over half of the sample resided in England (56.9%) and over half (56.7%) reported a female gender. Almost six in ten were aged 18 to 39 years (57.2%) with 25.0% aged 50 years and over. Over a third were resident in households in the two most deprived quintiles (35.8%), with four in ten living in the two least deprived quintiles (40.8%). The majority reported white ethnicity (83.8%).

Table 1: Sample demographics

		Number	Percentage
Gender	Male	734	43.3
	Female	962	56.7
Age group (years)	18 to 29	476	28.1
	30 to 39	493	29.1
	40 to 49	303	17.9
	50 to 59	227	13.4
	60 plus	197	11.6
Deprivation quintile	1 (most deprived)	216	12.7
	2	392	23.1
	3	395	23.3
	4	365	21.5
	5 (least deprived)	328	19.3
Ethnicity	White	1421	83.8
	Other than white	275	16.2
Study area	England	965	56.9
	Wales	731	43.1

3.1 ACE prevalence

Approximately two thirds (66.3%) of the sample reported exposure to at least one ACE before the age of 18 years, with approximately one in six (17.7%) reporting exposure to 4 or more ACE types. Across the nine ACEs measured, individual ACE prevalence ranged from 3.5% for household member incarceration to 37.9% for verbal abuse (see Figure 1). There was a significantly higher prevalence of ACEs among respondents living in Wales compared to those living in England (see Table 2 and Appendix Table A1).

Table 2: ACE count comparison across study areas

	Percentage			
	0 ACEs	1 ACE	2 to 3 ACEs	4 or more ACEs
England	35.4	23.3	25.9	15.3
Wales	31.3	21.2	26.7	20.8
X^2				10.014
p				0.018

Figure 1. Sample prevalence of individual ACEs and ACE count

Category	Percentage
Parental separation	30.0%
Mental illness	27.8%
Domestic violence	19.3%
Alcohol abuse	16.5%
Drug abuse	6.6%
Incarceration	3.5%
Verbal abuse	37.9%
Physical abuse	25.0%
Sexual abuse	9.0%
0 ACEs	33.7%
1 ACE	22.4%
2 to 3 ACEs	26.2%
4 or more ACEs	17.7%
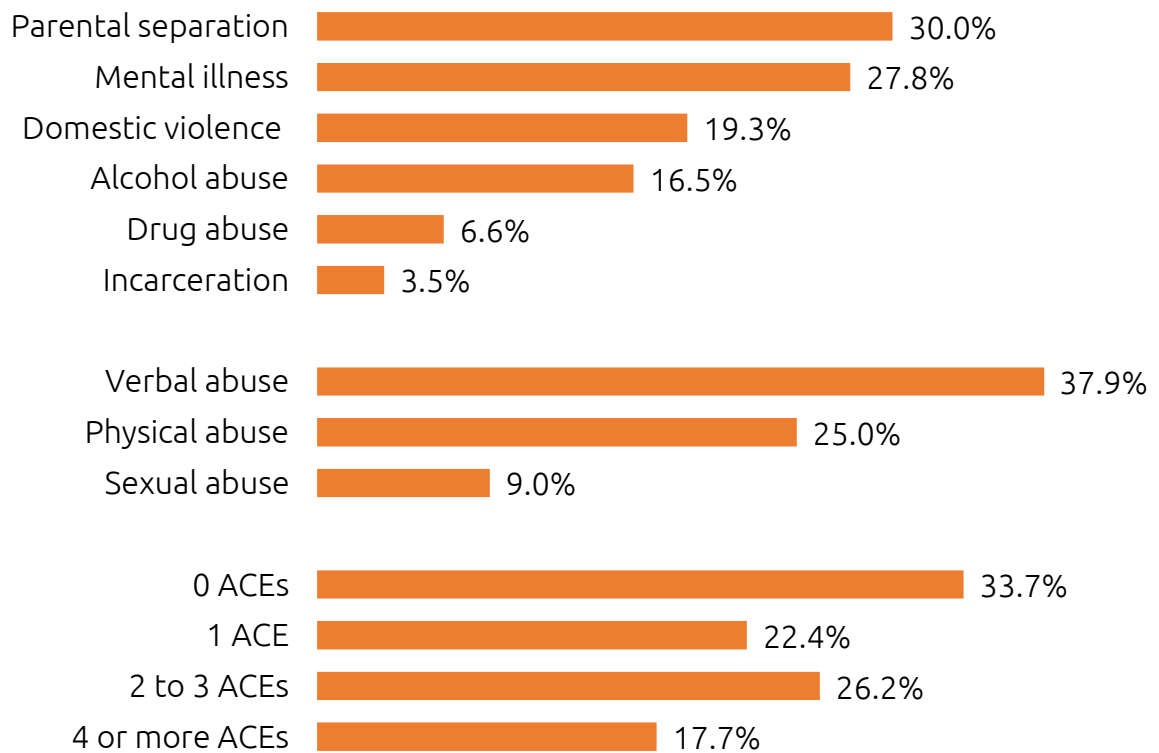
4. ACEs and medication use

Figure 2. Proportion reporting medication use by ACE count and adjusted odds ratios (AORs) for individuals with ACEs (compared with no ACEs)

	Prescribed antibiotics in last year	Currently taking prescription medicines	Poor medication adherence
	AOR	AOR	AOR
1 ACE	1.2	1.2	1.0
2 to 3 ACEs	1.2	1.5^{S}	1.6^{s}
4 or more ACEs	1.5^{S}	1.5^{S}	1.6^{s}
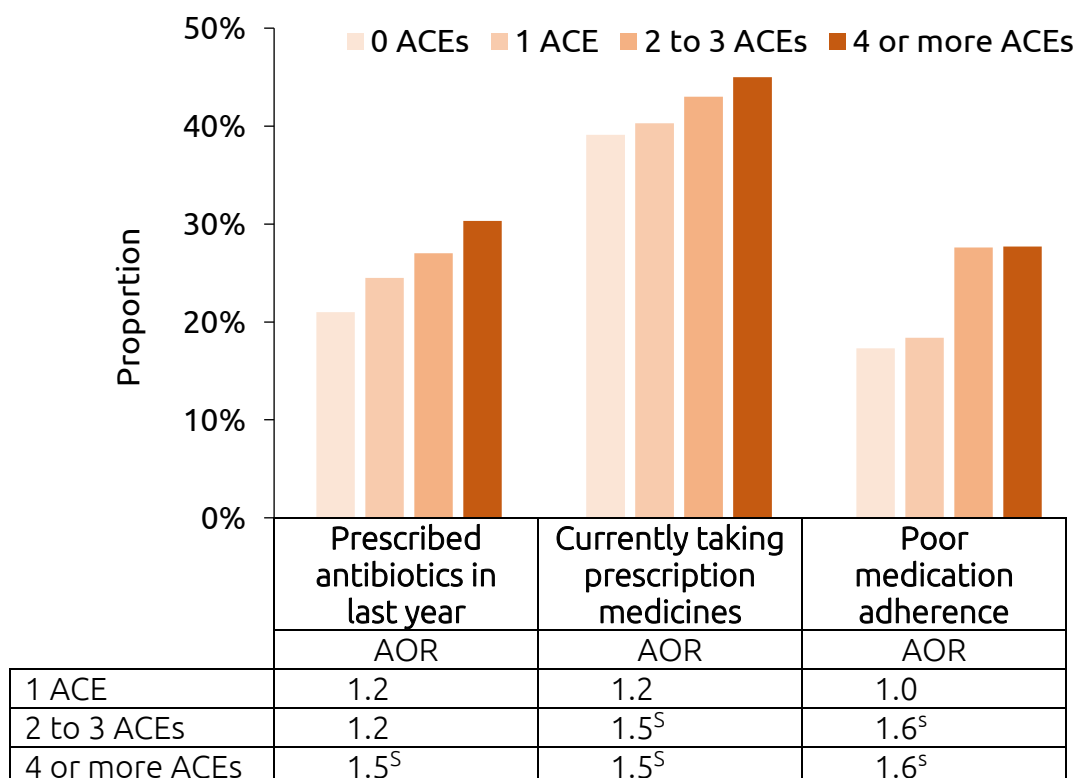
Note: $^{S}P<0.05$.

4.1 Prescribed antibiotics

Participants were asked how many times in the last 12 months they had been prescribed antibiotics. Those reporting at least once were coded as being prescribed antibiotics.

A quarter of participants (25.0%) reported having been prescribed antibiotics in the last 12 months. Prevalence increased from 21.0% of those with 0 ACEs to 30.3% of those with 4 or more ACEs (Figure 2). In logistic regression analysis controlling for demographic confounding (age, gender, ethnicity, IMD quintile and country of residence; see Section 2.2), individuals with 4 or more ACEs were 1.5 times more likely more likely to report being prescribed antibiotics (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE or 2 to 3 ACEs. Being prescribed antibiotics was significantly associated with being female and younger age (18 to 29 years; Appendix Table A2).

Those with 4 or more ACEs were

1.5 times

more likely to have been prescribed antibiotics than those with 0 ACEs

4.2 Currently taking prescription medicines

Participants were asked if they were currently taking any prescription medicines. Those reporting prescription medicines other than prescribed contraceptives and hormone replacement therapy (which were excluded as they are predominantly reported by females) were coded as taking prescription medicines.

Four in 10 participants (41.5%) reported they were currently taking prescription medicines. Prevalence increased from 39.1% of those with 0 ACEs to 45.0% of those with 4 or more ACEs (Figure 2). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs or 4 or more ACEs were 1.5 times more likely to report currently taking prescription medicines (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE. Currently taking prescription medicines was significantly associated with being female, white ethnicity and age group, with odds increasing with increasing age (Appendix Table A2).

> Those with 4 or more ACEs were
>
> **1.5 times**
>
> more likely to currently take prescription medicines than those with 0 ACEs

Participants were asked if their prescribed medicines were for chronic health conditions or mental ill-health (e.g., antidepressants). In bivariate analysis, only prescriptions for mental ill-health were associated with ACE count.

In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs and 4 or more ACEs were 1.6 and 2.1 times more likely to report having been prescribed medicines for mental ill-health respectively (compared to those with 0 ACEs; see Table 3 and Appendix Table A3). There was no significant increase in risk for those with 1 ACE. Individuals with 2 to 3 ACEs were 1.4 times more likely to have a prescription for a chronic health condition (compared to those with 0 ACEs). Increases in risk were not significant for those with 1 ACE or 4 or more ACEs.

Table 3. Adjusted odds ratios (AORs) for prescription medicines in individuals with ACEs (compared with no ACEs)

	17% reported a prescription for mental ill-health	29% reported a prescription for a chronic health condition
	AOR	AOR
1 ACE	1.1	1.3
2 to 3 ACEs	1.6[s]	1.4[s]
4 or more ACEs	2.1[ss]	1.3

Note: [s]P<0.05, [ss]P<0.001.

4.3 Poor medication adherence

Participants were asked, when taking medication, if they usually take it exactly as instructed. Those reporting that they did not always take it exactly as instructed were coded as having poor medication adherence.

Over one in five participants (22.1%) reported poor medication adherence. Prevalence increased from 17.3% of those with 0 ACEs to 27.7% of those with 4 or more ACEs (Figure 2). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs or 4 or more ACEs were 1.6 times more likely more likely to report poor medication adherence (compared with those with 0 ACEs). There was no increase in risk in those with 1 ACE. Poor medication adherence was also significantly associated with age, with individuals aged over 60 years least likely to report that they did not always take medication exactly as instructed. Odds of reporting poor medication adherence were highest in the second most deprived quintile compared with the least deprived (Appendix Table A2).
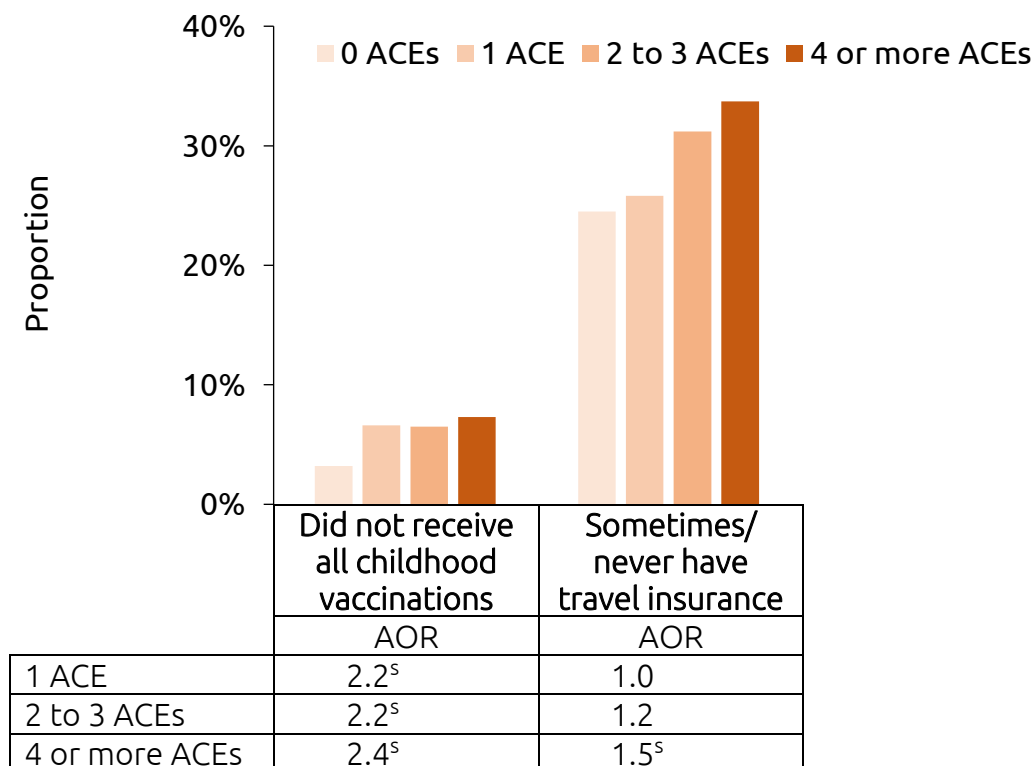
Those with 4 or more ACEs were

1.6 times

more likely to have poor medication adherence than those with 0 ACEs

5. ACEs and preventative healthcare

Figure 3. Proportion reporting preventative healthcare by ACE count and adjusted odds ratios (AORs) for individuals with ACEs (compared with no ACEs)

	Did not receive all childhood vaccinations	Sometimes/ never have travel insurance
	AOR	AOR
1 ACE	2.2^s	1.0
2 to 3 ACEs	2.2^s	1.2
4 or more ACEs	2.4^s	1.5^s

Note: ^{s}P<0.05.

5.1 Did not receive all childhood vaccinations

Participants were asked if, to their knowledge, they received all their available routine vaccinations as a child. Those reporting no and don't know were coded as having not received all their childhood vaccinations (those reporting they were not able to receive their vaccine due to egg allergy were coded as having had their vaccines).

One in 20 participants (5.5%) reported they had not received all their childhood vaccinations. Prevalence increased from 3.2% of those with 0 ACEs to 7.3% of those with 4 or more ACEs (Figure 3). In logistic regression analysis, controlling for demographic confounding, individuals with 1 ACE or 2 to 3 ACEs were 2.2 times more likely to report having not received all their childhood vaccinations and those with 4 or more ACEs were 2.4 times more likely (compared with those with 0 ACEs). There were no significant associations between receiving childhood vaccinations and other demographic confounders (Appendix Table A4).

Those with 4 or more ACEs were

2.4 times

more likely to have not received all childhood vaccinations than those with 0 ACEs

5.2 Sometimes/never have health insurance when travelling abroad

Participants were asked if they ensure they have health insurance when travelling abroad. Those reporting that they sometimes or never had insurance were coded as sometimes/never having travel insurance.

Of those who reported that they travelled abroad (n=1,492), over a quarter (28.1%) reported they sometimes/never have health insurance when they travel. Prevalence increased from 24.5% of those with 0 ACEs to 33.7% of those with 4 or more ACEs (Figure 3). In logistic regression analysis, controlling for demographic confounding, individuals with 4 or more ACEs were 1.5 times more likely to report sometimes/never having travel insurance (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE or 2 to 3 ACEs. Sometimes/never having travel insurance was significantly associated with being male, being aged 18 to 29 years, other than white ethnicity and residing in England (Appendix Table A4).

Those with 4 or more ACEs were

1.5 times

more likely to sometimes/never have travel insurance than those with 0 ACEs

6. ACEs and relationships with healthcare professionals and systems

Figure 4. Proportion reporting relationships with healthcare professionals and systems by ACE count and adjusted odds ratios (AORs) for individuals with ACEs (compared with no ACEs)

	Perceive that professionals do not care about their health	Perceive that professionals do not understand their problems	Poor childhood experience with health services	Poor childhood experience with social services
	AOR	AOR	AOR	AOR
1 ACE	1.4	1.5^{s}	0.9	1.0
2 to 3 ACEs	2.0^{ss}	2.6^{ss}	3.0^{ss}	1.5
4 or more ACEs	3.6^{ss}	3.5^{ss}	3.4^{ss}	2.8^{ss}
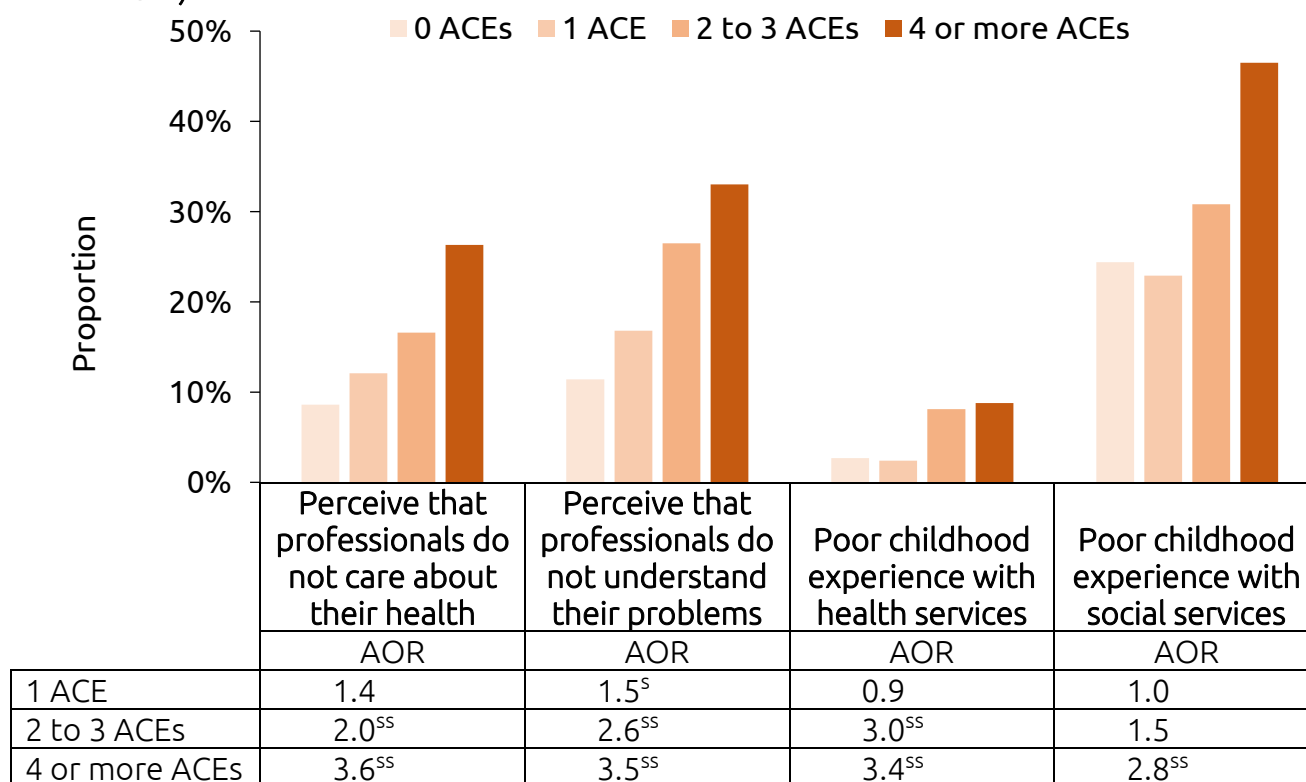
Note: ^{s}P<0.05, ^{ss}P<0.001.

6.1 Perceive that professionals do not care about their health

Participants were asked how much they agreed or disagreed with the statement "I feel like health professionals care about my health". Those responding strongly disagree or disagree were coded as perceiving that professionals do not care about their health.

Almost one in seven participants (14.6%) perceived that professionals do not care about their health. Prevalence increased from 8.6% of those with 0 ACEs to 26.3% of those with 4 or more ACEs (Figure 4). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 2.0 times more likely to perceive that professionals do not care about their health and those with 4 or more ACEs were 3.6 times more likely (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE. Perceiving that professionals do not care about their health was also associated with being female and deprivation level, with risks higher in the second most deprived quintile compared with the least deprived. Risks were lowest in those aged 50 to 59 years compared with those 18 to 29 (Appendix Table A5).

Those with 4 or more ACEs were

3.6 times

more likely to perceive that professionals do not care about their health than those with 0 ACEs

6.2 Perceive that professionals do not understand their problems

Participants were asked how much they agreed or disagreed with the statement "I feel like health professionals understand my problems". Those responding strongly disagree or disagree were coded as perceiving that professionals do not understand their problems.

One in five participants (20.4%) perceived that professionals do not understand their problems. Prevalence increased from 11.4% of those with 0 ACEs to 33.0% of those with 4 or more ACEs (Figure 4). In logistic regression analysis, controlling for demographic confounding, individuals were 1.5, 2.6 and 3.5 times more likely to perceive that professionals do not understand their problems when they reported 1 ACE, 2 to 3 ACEs or 4 or more ACEs respectively (compared with those with 0 ACEs). Perceiving that professionals do not understand their problems was significantly associated with being female. Risks were lowest in those aged over 50 years compared to those aged 18 to 29 years (Appendix Table A5).

> Those with 4 or more ACEs were
>
> ## 3.5 times
>
> more likely to perceive that professionals do not understand their problems than those with 0 ACEs

6.3 Poor childhood experience with health services

Participants were asked to rate their childhood experience of health services using a scale of 0 (extremely poor) to 10 (extremely good). Those who provided scores of 0 to 4 were coded as having poor childhood experience with health services.

Of those who interacted with health services as a child (n=1,682), one in 20 (5.1%) reported that they had a poor experience. Prevalence increased from 2.4% of those with 1 ACE to 8.8% of those with 4 or more ACEs (Figure 4). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 3.0 times more likely to report a poor childhood experience with health services, with those with 4 or more ACEs 3.4 times more likely (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE. Whilst there were no overall significant associations with other demographics, risks of poor childhood experiences with health services were elevated in 18 to 29 year olds (Appendix Table A5).

> Those with 4 or more ACEs were
>
> ## 3.4 times
>
> more likely to report poor childhood experiences with health services than those with 0 ACEs

6.4 Poor childhood experience with social services

Participants were asked to rate their childhood experience of social services using a scale of 0 (extremely poor) to 10 (extremely good). Those who provided scores of 0 to 4 were coded as having poor childhood experience with social services.

Of those who interacted with social services as a child (n=450), one in three (32.0%) reported that they had a poor experience. Prevalence increased from 22.9% of those with 1 ACE to 46.5% of those with 4 or more ACEs (Figure 4). In logistic regression analysis, controlling for demographic confounding, individuals with 4 or more ACEs were 2.8 times more likely to report a poor childhood experience with social services (compared with those with 0 ACEs). There was no significant increase in risk in those with 1 ACE or 2 to 3 ACEs. Reporting a poor childhood experience with social services was not significantly associated with other demographic confounders (Appendix Table A5).
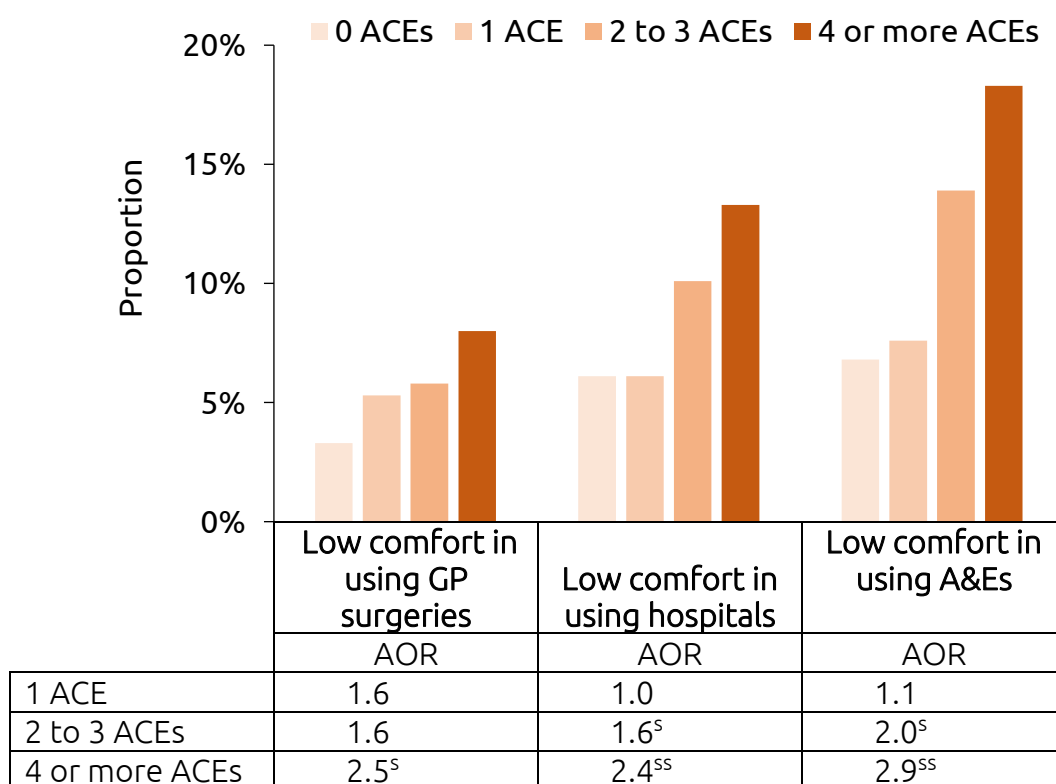
Those with 4 or more ACEs were

2.8 times

more likely to report poor childhood experiences with social services than those with 0 ACEs

7. ACEs and comfort in using healthcare settings

Figure 5. Proportion reporting low comfort in using healthcare settings by ACE count and adjusted odds ratios (AORs) for individuals with ACEs (compared with no ACEs)

	Low comfort in using GP surgeries	Low comfort in using hospitals	Low comfort in using A&Es
	AOR	AOR	AOR
1 ACE	1.6	1.0	1.1
2 to 3 ACEs	1.6	1.6^s	2.0^s
4 or more ACEs	2.5^s	2.4^{ss}	2.9^{ss}

Note: ^{s}P<0.05, ^{ss}P<0.001.

7.1 Low comfort in using GP surgeries

Participants were asked how comfortable they feel using GP surgeries using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in using GP surgeries.

One in 20 (5.2%) participants reported low comfort in using GP surgeries. Prevalence increased from 3.3% of those with 0 ACEs to 8.0% of those with 4 or more ACEs (Figure 5). In logistic regression analysis, controlling for demographic confounding, individuals with 4 or more ACEs were 2.5 times more likely to report low comfort in using GP surgeries (compared with those with 0 ACEs). The increase in risk in those with 1 ACE and 2 to 3 ACEs was not significant. Low comfort in using GP surgeries was also significantly associated with other than white ethnicity (Appendix Table A6).

Those with 4 or more ACEs were

2.5 times

more likely to have low comfort in using GP surgeries than those with 0 ACEs

7.2 Low comfort in using hospitals

Participants were asked how comfortable they feel using hospitals, using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in using hospitals.

Less than one in 10 (8.4%) participants reported low comfort in using hospitals. Prevalence increased from 6.1% of those with 0 or 1 ACE to 13.3% of those with 4 or more ACEs (Figure 5). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 1.6 times more likely to report low comfort in using hospitals and those with 4 or more ACEs were 2.4 times more likely (compared with those with 0 ACEs). There was no increase in risk in those with 1 ACE and low comfort in using hospitals was not significantly associated with other demographic confounders (Appendix Table A6).

Those with 4 or more ACEs were

2.4 times

more likely to have low comfort in using hospitals than those with 0 ACEs

7.3 Low comfort in using Accident and Emergency Departments (A&Es)

Participants were asked how comfortable they feel using A&Es, using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in using A&Es.

One in ten (10.9%) participants reported low comfort in using A&Es. Prevalence increased from 6.8% of those with 0 ACEs to 18.3% of those with 4 or more ACEs (Figure 5). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 2.0 times more likely to report low comfort in using A&Es and those with 4 or more ACEs were 2.9 times more likely (compared with those with 0 ACEs). There was no increase in risk in those with 1 ACE. Low comfort in using A&Es was also significantly associated with being female. Risk of low comfort in using A&Es was highest in those aged 18 to 29 (Appendix Table A6).

Those with 4 or more ACEs were

2.9 times

more likely to have low comfort in using A&Es than those with 0 ACEs

Figure 6. Proportion reporting low comfort in using healthcare settings by ACE count and adjusted odds ratios (AORs) for individuals with ACEs (compared with no ACEs)

	Low comfort in home visits from a health professional	Low comfort in using community centres that provide health support	Low comfort in using dental surgeries
	AOR	AOR	AOR
1 ACE	1.6^s	1.4	1.4
2 to 3 ACEs	1.3	1.6^s	1.9^s
4 or more ACEs	1.7^s	1.7^s	2.6^{ss}

Note: ^{s}P<0.05, ^{ss}P<0.001.

7.4 Low comfort in having home visits from a health professional

Participants were asked how comfortable they feel in having home visits from a health professional (e.g. GP, midwife) using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in having home visits.
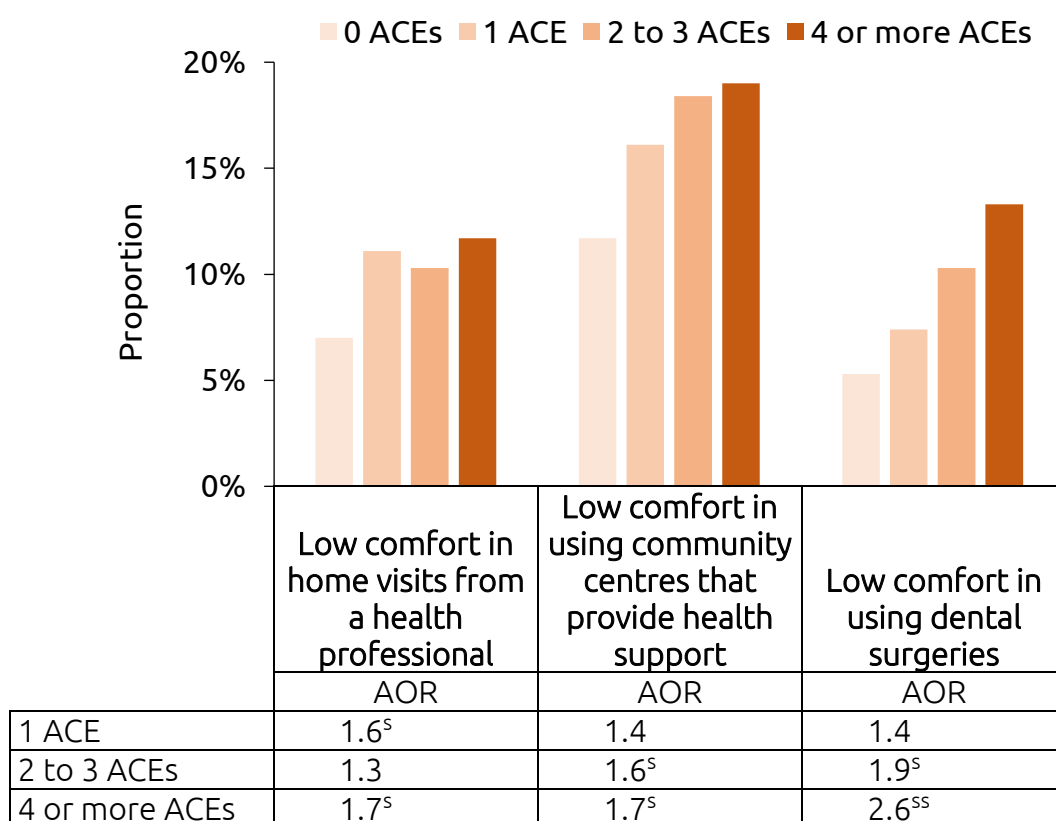
One in ten (9.6%) participants reported low comfort in home visits from a health professional. Prevalence increased from 7.0% of those with 0 ACEs to 11.7% of those with 4 or more ACEs (Figure 6). In logistic regression analysis, controlling for demographic confounding, individuals with 1 ACE were 1.6 times more likely to report low comfort in home visits from a health professional and those with 4 or more ACEs were 1.7 times more likely (compared with those with 0 ACEs). The increase in risk in those with 2 to 3 ACEs was not significant. Low comfort in home visits was also significantly associated with other than white ethnicity. Risk of low comfort in home visits from a health professional was highest in those aged 18 to 29 (Appendix Table A7).

Those with 4 or more ACEs were

1.7 times

more likely to have low comfort in having home visits from a health professional than those with 0 ACEs

7.5 Low comfort in using community centres that provide health support

Participants were asked how comfortable they feel using community centres that provide health support using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in community centres.

Around one in seven (15.7%) participants reported low comfort in using community centres. Prevalence increased from 11.7% of those with 0 ACEs to 19.0% of those with 4 or more ACEs (Figure 6). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 1.6 times more likely to report low comfort in using community centres and those with 4 or more ACEs were 1.7 times more likely (compared with those with 0 ACEs). The increase in risk in those with 1 ACE was not significant. Low comfort in using community centres was also significantly associated with being in the youngest age group (age 18 to 29; Appendix Table A7).

> Those with 4 or more ACEs were
>
> ## 1.7 times
>
> more likely to have low comfort in using community centres than those with 0 ACEs

7.6 Low comfort in using dental surgeries

Participants were asked how comfortable they feel using dental surgeries using a scale of 0 (not at all) to 10 (completely). Those who provided scores of 0 to 4 were coded as having low comfort in dental surgeries.

Almost one in ten (8.5%) participants reported low comfort in using dental surgeries. Prevalence increased from 5.3% of those with 0 ACEs to 13.3% of those with 4 or more ACEs (Figure 6). In logistic regression analysis, controlling for demographic confounding, individuals with 2 to 3 ACEs were 1.9 times more likely to report low comfort in using dental surgeries and those with 4 or more ACEs were 2.6 times more likely (compared with those with 0 ACEs). The increase in risk in those with 1 ACE was not significant. Low comfort in using dental surgeries was also significantly associated with being female, younger age and residing in England. Odds of low comfort in using dental surgeries were also highest in the second most deprived quintile compared with the least deprived (Appendix Table A7).

> Those with 4 or more ACEs were
>
> ## 2.6 times
>
> more likely to have low comfort in using dental surgeries than those with 0 ACEs

8. Discussion

Despite a growing body of research identifying relationships between ACEs and increased risks of ill health and healthcare use [3–5, 10, 22], evidence linking ACEs to the use of healthcare remains scant, particularly in the UK. This pilot study has developed further knowledge on the associations between having a history of ACEs and the use of healthcare and has provided novel data on the links between ACEs and relationships with healthcare professionals.

Consistent with previous research [8, 23], we found high ACE exposure to be associated with greater medication use. Individuals with four or more ACEs were more likely to report having been prescribed antibiotics in the last 12 months and to be currently using prescription medicine. This may reflect greater vulnerability to ill health and consequently greater need for health treatment in individuals with a history of ACEs. In particular, we found that having two or more ACEs was associated with current use of prescription medicine for mental ill-health, with odds of reporting such a prescription being doubled in those with four or more ACEs. This reflects the known strong relationships between ACEs and mental ill-health [24]. These findings further our understanding of the impact that ACEs can have on unequal patterns of medication use.

Alongside increased prescription drug use, we found a relationship between ACEs and medication adherence, with individuals with two or more ACEs being more likely to report poor medication adherence. For medication to work properly and to reduce the potential for negative side effects from its use, it is important that instructions on how medication should be taken are adhered to [25]. These findings are especially important in the context of the links between ACEs and antibiotic use identified here. Misuse of antibiotics in humans is a known driver of antibiotic resistance (i.e. when bacteria become drug-resistant). Therefore, health agencies globally have highlighted the need for public health action to ensure antibiotics are used appropriately [26, 27].

The relationship between ACEs and vaccinations is important given the recent UK trend for lower levels of uptake in routine childhood vaccinations [28]. We found that any ACE exposure was also linked to having not received all routine childhood vaccinations. Although this outcome is reliant on individuals' knowledge and recall of their vaccination history (see limitations below), it adds to a growing literature on how ACEs may be linked to vaccination uptake and the implications this may have for life course health [1, 12, 29]. A US study found no relationship between parental (maternal or paternal) history of ACEs and delayed or missed immunisations for their offspring by two years of age [30]. However, ACE exposure has been shown to be associated with COVID-19 vaccine hesitancy in adults [12] and low levels of flu vaccination, but not genital human papillomavirus (HPV) vaccination, in young adults [31]. Further research should explore the relationships between ACE exposure and childhood vaccination uptake in larger and more representative samples.

Research in the US has shown that individuals who are exposed to ACEs are more likely to not have health insurance [10, 22]. Here, a relationship was also identified between high ACE exposure and sometimes or never having health insurance when travelling abroad. Whilst the survey did not collect information on participants'

frequency or purpose of travelling abroad, this finding may be indicative of the association between high ACEs exposure and risk-taking behaviours [32].

Previous research has indicated that individuals with multiple ACEs may perceive public services as less supportive [15] and have less trust in medical professionals [16, 17]. However, there is a shortage of studies exploring relationships between ACEs and wider relationships with healthcare professionals. We found that individuals with multiple ACEs were substantially more likely to perceive that professionals do not care about their health or understand their problems, with odds of both outcomes doubling in those with 2 to 3 ACEs and tripling in those with four or more ACEs (compared to people with no ACEs). Individuals exposed to multiple ACEs were also more likely to report a poor childhood experience with health services. Given the association between ACEs and increased ill health and healthcare use, it is imperative that people with ACEs have positive interactions with healthcare services. Improving these relationships (e.g. through the provision of trauma-informed care; see below) may, in turn, increase trust in health professionals and adherence with healthcare and public health guidance.

To our knowledge, no previous studies have examined associations between ACEs and how comfortable people feel in using medical and healthcare settings. Here, individuals with four or more ACEs were more than twice as likely to report low comfort in using hospitals and GP and dental surgeries and almost three times more likely to have low comfort in using A&Es compared to individuals with no ACEs. Exposure to ACEs can affect emotional regulation and stress tolerance levels [33], which might influence individuals' comfort in their care experience. A trauma-informed approach in healthcare settings may help those who have experienced childhood adversity to feel more comfortable in using healthcare settings [34]. Ultimately, improving comfort may also improve trust and adherence to healthcare guidance. However, future research is needed to explore these relationships in more detail.

Our survey used an online sample, and respondents reported higher ACE exposure than in previous English and Welsh studies using face-to-face or telephone interviews; for example, two thirds (66.3%) reported exposure to at least one ACE, compared to less than half (45.4%) of respondents in an English and Welsh face-to-face sample [35]. The prevalence of verbal abuse, parental separation and living with a household member with mental illness were all markedly higher in this sample than other UK studies [36, 37]. Reasons for higher ACE exposure reported by this online sample may relate to greater willingness to report ACEs in the absence of an interviewer, or self-selection of participants with ACEs who felt the survey's content was relevant to them. Another recent ACE study that used mixed recruitment methods also found online participants reported a significantly higher ACE prevalence than those surveyed by telephone [38]. The higher prevalence of ACEs reported by respondents living in Wales compared to those living in England is consistent with findings from other studies [2]. As the study sample was not representative of each study area, all models adjusted for survey area.

There are further limitations that should be considered when interpreting study findings. The study was cross-sectional and therefore causality between outcomes cannot be established. As participation was voluntary it is not possible to identify or

exclude any bias created by a decision to not participate. All study data were self-reported and therefore subject to accurate reporting. Further, ACE measures were retrospective and may be subject to recall and willingness to disclose childhood adversities. The survey did not measure frequency of engagement with health and social services during childhood, and level of contact with these services may influence experience of them. Whilst our questions focused on comfort in using health services, further research should explore comfort in engaging with different health professionals (e.g. doctors) as this may impact overall comfort levels and healthcare engagement. It should also be recognised that a wide variety of health support can be provided within community services, which may vary geographically and thus affect responses to this outcome measure. Finally, despite attempts to achieve a representative sample, differences exist between the sample demographics and those of the Welsh and English populations and the use of an online sample will have limited participation by some vulnerable groups (e.g. those with no internet access). Analysis adjusted for participant demographics and country of residence, however further research should explore these relationships in representative samples.

Study findings indicate that early life experiences influence individuals' relationships with health services as adults. Despite increased use of medication, individuals with multiple ACEs may be less likely to take medication as directed and use preventative healthcare and may experience greater discomfort in using healthcare environments compared to those with no ACEs. These findings further our understanding of the lifelong impact of ACEs and the case for the prevention of childhood adversity. Future research should further examine the associations between ACEs and comfort with other health professionals and in different healthcare settings, as these are potential barriers to individuals who have experienced ACEs accessing care and support. Finally, findings are of use in the development of trauma-informed responses to ensure individuals who have experienced childhood adversity are effectively supported to live healthy lives.

References

1. Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. Lancet Public Health. 2017;2:e356-366.

2. Hughes K, Ford K, Kadel R, Sharp CA, Bellis MA. Health and financial burden of adverse childhood experiences in England and Wales: a combined primary data study of five surveys. BMJ Open. 2020;10:e036374.

3. Bellis M, Hughes K, Hardcastle K, Ashton K, Ford K, Quigg Z, et al. The impact of adverse childhood experiences on health service use across the life course using a retrospective cohort study. Journal of Health Services Research & Policy. 2017;22:168–77.

4. Chartier MJ, Walker JR, Naimark B. Separate and cumulative effects of adverse childhood experiences in predicting adult health and health care utilization. Child Abuse and Neglect. 2010;34:454–64.

5. Bonomi AE, Anderson ML, Rivara FP, Cannon EA, Fishman PA, Carrell D, et al. Health care utilization and costs associated with childhood abuse. Journal of General Internal Medicine. 2008;23:294–9.

6. Anda RF, Brown DW, Dube SR, Bremner JD, Felitti VJ, Giles WH. Adverse childhood experiences and chronic obstructive pulmonary disease in adults. American Journal of Preventive Medicine. 2008;34:396–403.

7. Koskenvuo K, Koskenvuo M. Childhood adversities predict strongly the use of psychotropic drugs in adulthood: a population-based cohort study of 24,284 Finns. Journal of Epidemiology & Community Health. 2015;69:354–60.

8. Anda RF, Brown DW, Felitti VJ, Dube SR, Giles WH. Adverse childhood experiences and prescription drug use in a cohort study of adult HMO patients. BMC Public Health. 2008;8:198.

9. Björkenstam E, Vinnerljung B, Hjern A. Impact of childhood adversities on depression in early adulthood: A longitudinal cohort study of 478,141 individuals in Sweden. Journal of Affective Disorders. 2017;233:95-100.

10. Alcalá HE, Valdez-Dadia A, von Ehrenstein OS. Adverse childhood experiences and access and utilization of health care. Journal of Public Health. 2018;40:684–92.

11. Alcalá H, Keim-Malpass J, Mitchell E. Colorectal cancer screening and adverse childhood experiences: Which adversities matter? Child Abuse and Neglect. 2017;69:145–50.

12. Bellis MA, Hughes KE, Ford K, Madden HCE, Glendinning F, Wood S. Associations between adverse childhood experiences, attitudes towards COVID-19 restrictions and vaccine hesitancy: a cross-sectional study. BMJ Open. 2021;12:e053915.

13. Ford K, Hughes K, Janssen H, Bellis MA. Adverse childhood experiences and COVID-19 in Bolton. Wrexham: Public Health Wales NHS Trust and Bangor University. 2022.

14. Hepp J, Schmitz SE, Urbild J, Zauner K, Niedtfeld I. Childhood maltreatment is associated with distrust and negatively biased emotion processing. Borderline Personality Disorder and Emotional Dysregulation. 2021;8:1–14.

15. Hughes K, Ford K, Davies AR, Homolova L, Bellis MA. Sources of resilience and their moderating relationships with harms from adverse childhood experiences. Wrexham: Public Health Wales NHS Trust and Bangor University. 2018.

16. Munoz RT, Hanks H, Brahm NC, Miller CR, McLeod D, Fox MD. Adverse childhood experiences and trust in the medical profession among young adults. Journal of Health Care for the Poor and Underserved. 2019;30:238–48.

17. Bellis MA, Hughes K, Ford K, Sharp C, Hill R. Associations between adverse childhood experiences and trust in health and other information from public services, professionals and wider sources: a national cross-sectional survey. Under Review.

18. Centers for Disease Control and Prevention: Behavioural Risk Factor Surveillance System. Available from: http://www.cdc.gov/brfss/, accessed 10/04/24.

19. Hughes K, Bellis MA, Hardcastle KA, Sethi D, Butchart A, Mikton C, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. Lancet Public Health. 2017;2:e356–66.

20. Welsh Government. Welsh Index of Multiple Deprivation 2019. 2019. Available from: https://www.gov.wales/welsh-index-multiple-deprivation-full-index-update-ranks-2019, accessed 10/04/24.

21. Ministry of Housing Communities & Local Government. The English Indices of Deprivation 2019 (IoD2019). 2019. Available from: https://www.gov.uk/government/statis tics/english-indices-of-deprivation-2019, accessed 10/04/24.

22. Testa A, Jackson DB, Vaughn MG, Ganson KT, Nagata JM. Adverse Childhood Experiences, health insurance status, and health care utilization in middle adulthood. Social Science & Medicine. 2022;314:115194.

23. Hardcastle K, Bellis MA, Sharp CA, Hughes K. Exploring the health and service utilisation of general practice patients with a history of adverse childhood experiences (ACEs): an observational study using electronic health records. BMJ Open. 2020;10:e036239.

24. Sahle BW, Reavley NJ, Li W, Morgan AJ, Yap MBH, Reupert A, et al. The association between adverse childhood experiences and common mental disorders and suicidality: an umbrella review of systematic reviews and meta-analyses. European Child & Adolescent Psychiatry. 2022;31:1489-1499.

25. Walsh CA, Cahir C, Tecklenborg S, Byrne C, Culbertson MA, Bennett KE. The association between medication non-adherence and adverse health outcomes in ageing populations: A systematic review and meta-analysis. British Journal of Clinical Pharmacology. 2019;85:2464.

26. Poudel AN, Zhu S, Cooper N, Little P, Tarrant C, Hickman M, et al. The economic burden of antibiotic resistance: A systematic review and meta-analysis. PLoS One. 2023;18:e0285170.

27. World Health Organization. Antimicrobial resistance. 2023. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance, accessed 31/01/24.

28. UK Health Security Agency. Quarterly vaccination coverage statistics for children aged up to 5 years in the UK (COVER programme): July to September 2022. 2023. Available from: https://www.gov.uk/government/statistics/cover-of-vaccination-evaluated-rapidly-cover-programme-2022-to-2023-quarterly-data/quarterly-vaccination-coverage-statistics-for-children-aged-up-to-5-years-in-the-uk-cover-programme-july-to-september-2022, accessed 16/01/24.

29. Bellis MA, Hughes K, Ford K, Ramos Rodriguez G, Sethi D, Passmore J. Life course health consequences and associated annual costs of adverse childhood experiences across Europe and North America: a systematic review and meta-analysis. Lancet Public Health. 2019;4:e517-528.

30. Eismann EA, Folger AT, Stephenson NB, Brownrigg ME, Shapiro RA, Macaluso M, et al. Parental Adverse Childhood Experiences and Pediatric Healthcare Use by 2 Years of Age. J Pediatrics. 2019;211:146–51.

31. Zhang S, Richardson BA, Lin J, Winer RL. The Association Between Adverse Childhood Experiences and Human Papillomavirus Vaccination Coverage in US Young Adults: A Cross-Sectional Study. Sexually Transmitted Diseases. 2023;50:656–63.

32. Campbell JA, Walker RJ, Egede LE. Associations Between Adverse Childhood Experiences, High-Risk Behaviors, and Morbidity in Adulthood. American Journal of Preventive Medicine. 2016;50:344–52.

33. Rudenstine S, Espinosa A, McGee AB, Routhier E. Adverse childhood events, adult distress, and the role of emotion regulation. Traumatology. 2019;25:124–32.

34. Purkey E, Davison C, MacKenzie M, Beckett T, Korpal D, Soucie K, et al. Experience of emergency department use among persons with a history of adverse childhood experiences. BMC Health Service Research. 2020;20:1–10.

35. Hardcastle K, Bellis MA, Ford K, Hughes K, Garner J, Ramos Rodriguez G. Measuring the relationships between adverse childhood experiences and educational and employment success in England and Wales: findings from a retrospective study. Public Health. 2018;165:106–16.

36. Hughes K, Lowey H, Quigg Z, Bellis MA. Relationships between adverse childhood experiences and adult mental well-being: results from an English national household survey. BMC Public Health. 2016;16:222.

37. Bellis MA, Ashton K, Hughes K, Ford K, Bishop J, Paranjothy S. Adverse childhood experiences and their impact on health-harming behaviours in the Welsh population. Cardiff: Public Health Wales NHS Trust. 2015.

38. Ford K, Hughes K, Cresswell K, Griffith N, Bellis MA. Associations between Adverse Childhood Experiences (ACEs) and Lifetime Experience of Car Crashes and Burns: A Cross-Sectional Study. International Journal of Environmental Research and Public Health. 2022;19:16036.

39. Centers for Disease Control and Prevention. Behavioural Risk Factor Surveillance System Adverse Childhood Experience (ACE) Module. Available from: https://www.cdc.gov/violenceprevention/pdf/brfss_adverse_module.pdf, accessed 10/04/24.

40. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. American Journal of Preventive Medicine. 1998;14:245-258.

Appendix 1. Methodology

Data collection was undertaken in March 2022 by Bangor University. The questionnaire was conducted with an online panel of participants who had opted to take part in paid online research studies, accessed via the Prolific commercial provider. A target sample of 1,500 individuals 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 [2]). The study inclusion criteria were:

- Resident in England and Wales
- Aged 18 years and over
- Cognitively able to participate.

Ethical approval for the study was granted by the Bangor University Healthcare Sciences Ethics and Research Committee (Ref 2022-17077).

Questionnaire

The questionnaire was developed by the research team. ACEs were measured using an established tool developed by the United States Centers for Disease Control and Prevention [39], based on the original ACE questionnaire developed by Felitti et al. 1998 [40]. The questions used to identify exposure to nine ACEs are shown in Table i.

Data were collected on a number of topics as described in the Methods section of the main report. Table ii outlines the questions and qualifying responses for all outcome measures included in the survey. Data on participant socio-demographics were also collected, including age, gender, ethnicity, postcode and country of residence. Further outputs will examine the relationships between ACEs and other outcomes measured within the survey but not analysed here.

Potential participants were provided with information on the study outlining that participation was voluntary and anonymous, and that a decision to not participate would not affect their rights, any current or future health treatment or any services they receive. Participants provided recorded opt-in consent prior to participation and on survey completion were provided with details for appropriate national support services. Due to the method of recruitment, we are unable to calculate a participation rate.

Calculation of ACE count

Responses to questions used to measure exposure to ACEs before the age of 18 years (see Table i) were scored to calculate the number of different ACEs they experienced - an individual's ACE score (range 0 to 9). Following a standard approach used in ACE studies internationally, this score was then classified into four ACE count categories:

- No ACEs (n=571)
- One ACE (n=380)
- Two to three ACEs (n=445)

- Four or more ACEs (n=300)

The ACE count provides a measure of the extent to an individual's exposure to ACEs and does not consider the timing, duration or frequency of exposure to ACEs. Nor does it identify any differential impacts of specific combinations of ACE types.

Table i: Questions measuring ACEs

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
Medication use		
Prescribed antibiotics	In the last 12 months (excluding for reasons relating to pregnancy) how many times have you been prescribed antibiotics? *(0 to 10 or more times)*	Once or more
Currently taking prescription medicine	Are you currently taking any prescription medicines? *(yes, no)*	Yes
Poor medication adherence	When taking medication do you… (*always take it exactly as instructed; I sometimes miss doses or do not finish the course of*	I sometimes miss doses or do not finish the course of medication; I often miss
Preventative healthcare		
Not received all childhood vaccines	To your knowledge, as a child did you receive all your available routine vaccinations (e.g. polio; measles)? *(yes; no, I didn't receive my routine vaccines due to allergies (e.g. egg); no, I didn't receive my routine vaccines; don't know)*	No, I didn't receive my routine vaccines or don't know
Sometimes/never have travel insurance	Do you ensure that you have health insurance when you travel abroad? *(never; sometimes; always; I do not travel abroad)*	Never or sometimes
Relationships with healthcare professionals and systems		
Perceive professionals do not care about their health	How much do you agree with the statement "I feel like health professionals care about my health"? *(strongly disagree; disagree, neither agree nor disagree; agree; strongly agree)*	Strongly disagree or disagree
Perceive professionals do not understand their problems	How much do you agree with the statement "I feel like health professionals understand my problems"? *(strongly disagree; disagree, neither agree nor disagree; agree; strongly agree)*	Strongly disagree or disagree
Poor childhood experience health services	Thinking back to your childhood, how would you rate your experience of health services using a scale of 0 to 10 where 0 is extremely poor and 10 is extremely good *(0, extremely poor to 10, extremely good; N/A I never used this service)*	0 to 4

Poor childhood experience with social services	Thinking back to your childhood, how would you rate your experience of social services using a scale of 0 to 10 where 0 is extremely poor and 10 is extremely good *(0, extremely poor to 10, extremely good; N/A I never used this service)*	0 to 4
Comfort in using healthcare settings		
Low comfort in using settings	On a scale of 0 to 10 where 0 is not at all and 10 is completely how comfortable would you feel using the following health settings? This does not include any concern you might have related to COVID-19 GP surgeries Hospitals Having home visits from a health professional (e.g. GP, midwife) Community centres that provide health support Dental surgeries Accident and emergency departments *(0 not at all - 10 completely)*	0 to 4

Appendix 2. Data tables
Table A1: Participant demographics by ACE exposure

| | % Individual ACEs | | | | | | | | | % ACE count | | | |
	Parental separation	Verbal abuse	Physical abuse	Sexual abuse	Mental illness	Domestic violence	Alcohol abuse	Incarceration	Drug abuse	0 ACEs	1 ACE	2 to 3 ACEs	4 or more ACEs
Gender													
Male	26.8	32.8	24.8	4.6	20.0	18.7	14.9	3.0	6.4	38.1	23.6	23.2	15.1
Female	32.3	41.7	25.2	12.3	33.7	19.9	17.7	3.8	6.8	30.2	21.5	28.6	19.6
X^2	5.979	13.862	0.029	29.738	38.687	0.378	2.411	0.893	0.084				17.983
p	0.014	<0.001	0.865	<0.001	<0.001	0.539	0.120	0.345	0.771				<0.001
Age group (years)													
18 to 29	35.7	40.8	21.2	7.4	34.7	18.3	18.1	3.8	9.9	28.4	23.3	29.0	19.3
30 to 39	35.7	41.0	28.2	9.1	30.2	21.9	19.7	3.7	7.1	28.4	22.5	28.4	20.7
40 to 49	28.1	38.0	28.4	11.9	28.7	18.8	14.2	3.6	5.9	36.0	18.5	29.0	16.5
50 to 59	22.9	34.4	23.8	9.3	20.7	18.1	15.9	1.8	2.6	39.2	26.4	18.5	15.9
60 plus	12.7	26.9	22.3	7.6	11.7	17.8	8.6	4.1	3.0	49.7	21.3	18.8	10.2
X^2	49.163	14.964	9.087	5.154	43.981	3.031	14.586	2.385	18.483				52.475
p	<0.001	0.005	0.059	0.272	<0.001	0.553	0.006	0.665	<0.001				<0.001
Deprivation quintile													
1 (most deprived)	37.0	45.8	30.1	11.6	30.6	26.9	21.3	6.5	11.1	25.0	22.7	24.5	27.8
2	30.4	39.3	28.6	11.0	27.3	20.4	16.3	4.1	4.1	31.1	22.7	29.1	17.1
3	32.4	37.5	25.8	8.1	28.1	21.8	20.0	3.8	8.9	31.4	21.8	28.1	18.7
4	27.1	37.5	22.7	7.9	26.6	17.5	14.5	2.7	6.8	36.7	21.4	26.6	15.3
5 (least deprived)	25.0	31.7	18.9	7.0	27.4	12.2	11.3	1.2	3.7	41.8	23.8	21.3	13.1
X^2	11.557	11.496	13.296	6.092	1.179	21.095	14.683	11.924	19.069				36.883
p	0.021	0.022	0.010	0.192	0.882	<0.001	0.005	0.018	<0.001				<0.001
Ethnicity													
White	30.3	37.2	22.8	8.6	28.6	18.1	16.5	3.1	6.5	35.1	22.5	24.5	17.9
Other than white	28.0	41.1	36.4	10.9	23.6	25.8	16.0	5.5	7.3	26.2	21.8	35.3	16.7
X^2	0.597	1.462	22.605	1.525	2.798	8.831	0.048	3.816	0.238				15.895
p	0.440	0.227	<0.001	0.217	0.094	0.003	0.826	0.051	0.626				0.001

Study area

England	26.8	35.3	23.5	8.8	24.9	18.5	14.8	3.2	6.0	35.4	23.3	25.9	15.3	
Wales	34.1	41.2	26.9	9.2	31.6	20.4	18.6	3.8	7.4	31.3	21.2	26.7	20.8	
X^2	10.344	6.029	2.604	0.065	9.392	0.897	4.338	0.473	1.278				10.014	
p	0.001	0.014	0.107	0.799	0.002	0.344	0.037	0.492	0.258				0.018	

Table A2: Adjusted odds ratios (AORs) for prescribed antibiotics, currently taking prescription medication and poor medication adherence outcomes in demographic and ACE count groups

	Prescribed antibiotics			Currently taking prescription medication			Poor medication adherence		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Gender									
Female	1.69	1.33-2.14	<0.001	1.42	1.15-1.75	0.001	1.10	0.86-1.40	0.450
Age group (years)									
18 to 29	Ref		0.004	Ref		<0.001	Ref		<0.001
30 to 39	0.77	0.58-1.03	0.075	1.20	0.91-1.57	0.201	1.00	0.74-1.35	0.986
40 to 49	0.64	0.46-0.90	0.010	2.16	1.59-2.93	<0.001	1.28	0.92-1.79	0.148
50 to 59	0.49	0.33-0.74	<0.001	2.85	2.04-3.99	<0.001	0.86	0.58-1.28	0.458
60 plus	0.65	0.43-0.98	0.042	4.46	3.09-6.43	<0.001	0.32	0.18-0.56	<0.001
Deprivation quintile									
1 (most deprived)	1.17	0.78-1.76	0.434	1.06	0.74-1.53	0.752	1.18	0.76-1.83	0.470
2	0.83	0.58-1.19	0.320	0.90	0.66-1.23	0.519	1.53	1.06-2.23	0.025
3	1.11	0.79-1.57	0.556	1.00	0.73-1.36	0.995	1.44	0.99-2.09	0.058
4	1.03	0.72-1.47	0.870	0.92	0.67-1.26	0.588	1.22	0.82-1.79	0.327
5 (least deprived)	Ref		0.402	Ref		0.875	Ref		0.174
Ethnicity									
Other than white	1.04	0.76-1.41	0.815	0.54	0.40-0.73	<0.001	1.06	0.77-1.45	0.736
ACE count									
0	Ref		0.155	Ref		0.009	Ref		0.002
1	1.16	0.84-1.58	0.365	1.20	0.91-1.58	0.202	1.02	0.72-1.44	0.911
2 to 3	1.24	0.92-1.68	0.151	1.49	1.14-1.95	0.004	1.62	1.19-2.20	0.002
4 or more	1.45	1.05-2.02	0.026	1.54	1.14-2.08	0.005	1.62	1.15-2.28	0.006
Study area									
Wales	0.98	0.78-1.24	0.866	1.06	0.86-1.31	0.564	1.05	0.82-1.34	0.701

95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.

Table A3: Adjusted odds ratios (AORs) for prescription medicine outcomes in demographic and ACE count groups

	Prescription for mental ill-health			Prescription for a chronic health condition		
	AOR	95% CIs	P	AOR	95% CIs	P
Gender						
Female	1.85	1.39-2.45	<0.001	1.11	0.88-1.41	0.366
Age group (years)						
18 to 29	Ref		0.270	Ref		<0.001
30 to 39	1.10	0.78-1.55	0.575	1.52	1.08-2.14	0.016
40 to 49	1.35	0.92-1.98	0.129	3.16	2.21-4.51	<0.001
50 to 59	1.01	0.65-1.58	0.968	5.72	3.93-8.33	<0.001
60 plus	0.76	0.46-1.27	0.297	9.30	6.23-13.86	<0.001
Deprivation quintile						
1 (most deprived)	1.34	0.84-2.13	0.215	1.05	0.70-1.58	0.822
2	1.08	0.72-1.63	0.707	1.05	0.74-1.48	0.781
3	1.07	0.71-1.61	0.749	1.11	0.79-1.57	0.546
4	1.09	0.72-1.65	0.692	0.84	0.59-1.20	0.347
5 (least deprived)	Ref		0.796	Ref		0.591
Ethnicity						
Other than white	0.28	0.17-0.47	<0.001	0.64	0.45-0.91	0.012
ACE count						
0	Ref		<0.001	Ref		0.094
1	1.09	0.74-1.60	0.671	1.26	0.92-1.71	0.147
2 to 3	1.62	1.14-2.30	0.007	1.44	1.07-1.95	0.017
4 or more	2.11	1.46-3.06	<0.001	1.34	0.95-1.88	0.091
Study area						
Wales	1.24	0.95-1.62	0.111	0.99	0.78-1.25	0.913

95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.

Table A4: Adjusted odds ratios (AORs) for preventative healthcare outcomes in demographic and ACE count groups

	Not received all childhood vaccines			Sometimes/never have travel insurance		
	AOR	95% CIs	P	AOR	95% CIs	P
Gender						
Female	0.70	0.45-1.07	0.097	0.61	0.47-0.78	<0.001
Age group (years)						
18 to 29	Ref		0.370	Ref		<0.001
30 to 39	0.56	0.32-1.01	0.053	0.46	0.34-0.61	<0.001
40 to 49	0.98	0.54-1.77	0.937	0.39	0.28-0.56	<0.001
50 to 59	0.89	1.45-1.75	0.732	0.20	0.12-0.32	<0.001
60 plus	0.86	0.40-1.82	0.686	0.20	0.12-0.33	<0.001
Deprivation quintile						
1 (most deprived)	1.60	0.79-3.25	0.196	1.12	0.71-1.76	0.628
2	1.47	0.77-2.81	0.242	0.79	0.54-1.17	0.246
3	0.79	0.39-1.63	0.528	0.90	0.61-1.31	0.570
4	0.98	0.48-2.00	0.962	1.12	0.77-1.63	0.559
5 (least deprived)	Ref		0.202	Ref		0.334
Ethnicity						
Other than white	1.02	0.57-1.83	0.954	2.68	1.98-3.62	<0.001
ACE count						
0	Ref		0.030	Ref		0.095
1	2.18	1.17-4.08	0.014	1.00	0.71-1.40	1.000
2 to 3	2.19	1.18-4.04	0.012	1.21	0.88-1.66	0.247
4 or more	2.40	1.25-4.61	0.009	1.52	1.06-2.17	0.024
Study area						
Wales	1.42	0.92-2.20	0.114	0.59	0.46-0.76	<0.001

95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.

Table A5: Adjusted odds ratios (AORs) for relationships with healthcare professionals and systems in demographic and ACE count groups

	Perceive that professionals do not care about their health			Perceive that professionals do not understand their problems			Poor childhood experience with health services (N=1682)			Poor childhood experience with social services (N=450)		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Gender												
Female	1.49	1.11-2.00	0.008	1.70	1.30-2.20	<0.001	1.39	0.86-2.22	0.175	1.27	0.84-1.92	0.261
Age group (years)												
18 to 29	Ref		0.176	Ref		0.052	Ref		0.321	Ref		0.391
30 to 39	0.83	0.58-1.18	0.290	0.97	0.72-1.32	0.867	0.56	0.31-0.99	0.047	1.16	0.68-1.98	0.593
40 to 49	0.95	0.63-1.41	0.787	0.75	0.52-1.09	0.131	0.89	0.48-1.62	0.695	1.37	0.72-2.59	0.337
50 to 59	0.54	0.32-0.92	0.022	0.58	0.37-0.90	0.016	0.69	0.32-1.50	0.351	1.74	0.85-3.58	0.132
60 plus	0.71	0.41-1.20	0.198	0.65	0.40-1.05	0.080	0.60	0.24-1.51	0.280	1.87	0.89-3.96	0.101
Deprivation quintile												
1 (most deprived)	0.70	0.40-1.22	0.204	0.86	0.54-1.36	0.513	0.89	0.38-2.09	0.797	1.41	0.66-3.01	0.376
2	1.61	1.05-2.46	0.029	1.41	0.97-2.07	0.073	1.38	0.70-2.74	0.350	1.67	0.82-3.38	0.155
3	1.10	0.70-1.71	0.684	0.93	0.63-1.38	0.720	0.89	0.43-1.85	0.757	1.03	0.50-2.13	0.926
4	1.00	0.63-1.59	0.987	1.01	0.68-1.50	0.963	1.04	0.50-2.15	0.918	1.13	0.55-2.31	0.744
5 (least deprived)	Ref		0.012	Ref		0.081	Ref		0.651	Ref		0.467
Ethnicity												
Other than white	0.80	0.54-1.20	0.280	0.83	0.59-1.18	0.300	1.31	0.75-2.29	0.350	1.02	0.62-1.69	0.940
ACE count												
0	Ref		<0.001	Ref		<0.001	Ref		<0.001	Ref		<0.001
1	1.44	0.94-2.22	0.094	1.51	1.03-2.20	0.033	0.87	0.37-2.01	0.743	0.96	0.49-1.87	0.896
2 to 3	1.97	1.33-2.91	<0.001	2.56	1.82-3.60	<0.001	2.98	1.59-5.58	<0.001	1.45	0.81-2.60	0.210
4 or more	3.64	2.44-5.44	<0.001	3.49	2.43-5.02	<0.001	3.40	1.75-6.63	<0.001	2.81	1.61-4.91	<0.001
Study area												
Wales	1.19	0.89-1.58	0.234	1.21	0.94-1.56	0.132	0.99	0.62-1.57	0.961	1.09	0.71-1.68	0.700

95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.

Table A6: Adjusted odds ratios (AORs) for low comfort in using healthcare settings in demographic and ACE count groups

	Low comfort in using GP surgeries			Low comfort in using hospitals			Low comfort in using A&Es		
	AOR	95% Cis	P	AOR	95% Cis	P	AOR	95% Cis	P
Gender									
Female	1.04	0.67-1.62	0.868	1.28	0.89-1.85	0.178	1.72	1.23-2.42	0.002
Age group (years)									
18 to 29	Ref		0.669	Ref		0.727	Ref		0.077
30 to 39	0.67	0.38-1.17	0.163	0.74	0.47-1.17	0.200	0.62	0.42-0.93	0.019
40 to 49	0.87	0.47-1.61	0.646	0.96	0.58-1.58	0.871	0.73	0.46-1.14	0.167
50 to 59	0.75	0.36-1.58	0.447	0.80	0.44-1.47	0.478	0.51	0.28-0.91	0.022
60 plus	0.67	0.28-1.58	0.359	0.97	0.51-1.82	0.915	0.70	0.39-1.27	0.241
Deprivation quintile									
1 (most deprived)	0.99	0.41-2.37	0.982	0.62	0.32-1.21	0.163	0.86	0.50-1.50	0.602
2	2.00	1.00-3.99	0.050	0.95	0.57-1.60	0.845	0.77	0.47-1.25	0.286
3	1.19	0.57-2.50	0.641	0.91	0.54-1.54	0.733	0.89	0.56-1.43	0.632
4	1.01	0.46-2.21	0.977	0.65	0.37-1.15	0.139	0.68	0.41-1.13	0.135
5 (least deprived)	Ref		0.104	Ref		0.386	Ref		0.613
Ethnicity									
Other than white	1.80	1.08-3.01	0.024	1.54	0.99-2.38	0.054	1.47	0.99-2.18	0.058
ACE count									
0	Ref		0.045	Ref		<0.001	Ref		<0.001
1	1.56	0.82-2.98	0.179	0.98	0.57-1.69	0.936	1.07	0.65-1.78	0.780
2 to 3	1.60	0.87-2.97	0.133	1.64	1.02-2.62	0.040	1.98	1.29-3.05	0.002
4 or more	2.51	1.33-4.73	0.005	2.43	1.49-3.98	<0.001	2.86	1.82-4.49	<0.001
Study area									
Wales	0.78	0.49-1.24	0.299	0.83	0.58-1.20	0.324	0.94	0.68-1.30	0.692

A&Es = Accident and Emergency Departments; 95% Cis = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.

Table A7: Adjusted odds ratios (AORs) for low comfort in using healthcare settings in demographic and ACE count groups

	Low comfort in home visits from a health professional			Low comfort in using community centres that provide health support			Low comfort in using dental surgeries		
	AOR	95% CIs	P	AOR	95% CIs	P	AOR	95% CIs	P
Gender									
Female	1.32	0.93-1.86	0.115	1.08	0.82-1.43	0.569	1.58	1.09-2.30	0.017
Age group (years)									
18 to 29	Ref		0.087	Ref		<0.001	Ref		0.004
30 to 39	0.74	0.49-1.11	0.141	0.48	0.34-0.68	<0.001	0.50	0.32-0.78	0.002
40 to 49	0.84	0.53-1.34	0.461	0.59	0.40-0.87	0.008	0.79	0.49-1.27	0.324
50 to 59	0.47	0.25-0.88	0.018	0.54	0.34-0.85	0.007	0.36	0.18-0.73	0.004
60 plus	0.51	0.26-1.02	0.057	0.59	0.36-0.95	0.031	0.50	0.25-1.00	0.050
Deprivation quintile									
1 (most deprived)	0.83	0.45-1.54	0.562	1.22	0.74-2.00	0.435	1.64	0.82-3.25	0.160
2	1.14	0.69-1.87	0.613	1.43	0.94-2.17	0.097	2.00	1.10-3.61	0.022
3	0.72	0.42-1.22	0.221	1.02	0.66-1.58	0.917	1.63	0.89-2.98	0.115
4	0.94	0.56-1.58	0.820	1.20	0.78-1.86	0.404	1.23	0.65-2.33	0.530
5 (least deprived)	Ref		0.427	Ref		0.399	Ref		0.150
Ethnicity									
Other than white	1.80	1.21-2.67	0.003	1.12	0.79-1.59	0.537	1.00	0.63-1.57	0.984
ACE count									
0	Ref		0.138	Ref		0.022	Ref		0.002
1	1.59	1.00-2.51	0.049	1.40	0.96-2.05	0.080	1.38	0.81-2.37	0.240
2 to 3	1.33	0.84-2.09	0.222	1.62	1.13-2.31	0.009	1.87	1.15-3.04	0.012
4 or more	1.67	1.02-2.73	0.040	1.74	1.17-2.58	0.006	2.61	1.56-4.34	<0.001
Study area									
Wales	0.76	0.54-1.08	0.129	0.78	0.59-1.04	0.089	0.63	0.43-0.92	0.016

95% CIs = 95% confidence intervals; Ref = Reference category. Reference categories for gender, ethnicity, and study area are male, white ethnicity, and England respectively.