


## Original Article

# Association of Adverse Childhood Experiences With Health-Related Quality of Life and Quality-Adjusted Life-Years Among Adolescents in the United Kingdom: Findings From Two General Population Cohorts

Amarech Obse<sup>1,\*</sup>, Kamaldeep Bhui<sup>2,3,4</sup>, Laura Havers<sup>5</sup>, Sania Shakoor<sup>5</sup>, Georgina Hosang<sup>5</sup>, Siobhan Hugh-Jones<sup>6</sup>, Minhua Ma<sup>7</sup>, Anna Mankee-Williams<sup>8</sup>, Alexis Karamanos<sup>9</sup>, Seeromanie Harding<sup>9</sup>, Paul McCrone<sup>1</sup>

<sup>1</sup>The Institute for Lifecourse Development, University of Greenwich, Old Royal Naval College, Park Row, SE10 9LS London, UK

<sup>2</sup>Department of Psychiatry, Nuffield Department of Primary Care Health Sciences, and Wadham College, University of Oxford, OX3 7JX Oxford, UK

<sup>3</sup>Oxford Health, Oxford and East London NHS Foundation Trusts, OX4 4XN London, UK

<sup>4</sup>World Psychiatric Association Collaborating Centre, OX3 7JX Oxford, UK

<sup>5</sup>Centre for Psychiatry and Mental Health, Wolfson Institute of Population Health, Queen Mary, University of London, E1 4NS London, UK

<sup>6</sup>School of Psychology, University of Leeds, LS2 9JT Leeds, UK

<sup>7</sup>Department of Psychiatry, University of Oxford, OX3 7JX Oxford, UK

<sup>8</sup>Research and Innovation Department, Falmouth University, TR10 9FE Falmouth, UK

<sup>9</sup>Department of Population Health Sciences, School of Life Course & Population Sciences, Faculty of Life Sciences and Medicine, King's College London, SE1 1UL London, UK

\*Correspondence: [a.obse@greenwich.ac.uk](mailto:a.obse@greenwich.ac.uk) (Amarech Obse)

Academic Editor: Francesco Bartoli

Submitted: 19 December 2025 Revised: 25 March 2026 Accepted: 2 April 2026 Published: 29 June 2026

## Abstract

**Background:** Evidence on the impact of adverse childhood experiences (ACEs) on multidimensional wellbeing, including health-related quality of life (HRQoL) and quality-adjusted life-years (QALYs), remains inadequate, particularly among young people. This study examines how ACEs and their interactions with sex, ethnicity, and socioeconomic status (SES) are associated with HRQoL and QALYs in United Kingdom (UK) adolescents. **Methods:** Baseline and follow-up data from the Determinants of Adolescent Social Well-being and Health (DASH) Study (N = 6648) and HeadStart Cornwall (HeadStart) (N = 4575) were used. ACE data were sourced from self-reports and official records and measured as binary and count variables. The Strengths and Difficulties Questionnaire (SDQ) was mapped to the Child Health Utility 9D (CHU9D) to calculate utility values for QALY estimation. **Results:** Over the 3- and 2-year follow-up periods, mean accumulated QALYs were 2.30 (standard error [SE]: 0.002) (DASH) and 1.45 (SE: 0.004) (HeadStart). The occurrence of any ACEs, self-reported and officially recorded, respectively, reduced QALYs by 0.064 (SE: 0.021) (DASH) and 0.060 (SE: 0.021) (HeadStart). These translate to losses of 23 (DASH) and 22 (HeadStart) days over the follow-up period. A greater count of ACEs was associated with stronger effects. Dose-dependent interactions were significant only for ACEs-ethnicity and ACEs-sex ( $\geq 2$  ACEs), with White adolescents and females experiencing greater QALY losses as the number of ACEs increased. **Conclusions:** ACEs, whether self-reported or officially recorded, were associated with greater QALY losses, with the strength of association increasing as the number of ACEs increased. Furthermore, White and female adolescents exposed to a greater number of ACEs had the highest QALY losses. Further studies are needed to investigate the moderation of these associations and the mechanisms underlying the associations between ACEs and HRQoL/QALYs to inform targeted interventions.

**Keywords:** adolescent; adverse childhood experiences; health-related quality of life; quality-adjusted life-year; United Kingdom

## Main Points

1. Adverse childhood experiences (ACEs) were associated with lower health-related quality of life (HRQoL) in adolescents.
2. Female adolescents had significantly lower quality-adjusted life years (QALYs) than males.
3. An increasing number of ACEs was linked to a graded reduction in HRQoL.
4. There was a dose-dependent interaction effect of ACEs and gender on QALYs.

## 1. Introduction

Adverse childhood experiences (ACEs) are stressful, often traumatic events occurring during childhood. These events have negative physical and psychological effects that can potentially last throughout the life course [1]. A landmark study on ACEs identified three groups of adversity occurring before the age of 18 that are linked with negative health consequences: abuse (physical, sexual, emotional), neglect (physical, emotional), and family dysfunction (divorce/separation, mental illness, substance misuse, domestic violence, and family member incarceration) [1].



A wealth of subsequent studies has corroborated these findings in different contexts [2]. An expanded definition of ACEs includes events experienced at a community level, such as witnessing violence, discrimination, unsafe neighbourhoods, bullying, and being placed in foster care, which have been shown to have similar effects on health and well-being [3].

Several large-scale reviews provide strong evidence for the disturbingly high global prevalence rates of ACEs. One meta-analysis of 244 publications from across the world estimated the prevalence of self-reported ACEs at 12.7% for sexual abuse (18% among girls and 7.6% among boys), 22.6% for physical abuse, and 36.3% for emotional abuse, with lower rates for ACEs recorded in official reports (0.4% for sexual abuse, 0.3% for physical abuse, and 0.3% for emotional abuse) [4]. A more recent systematic review of 337 global studies estimated higher rates of prevalence, with a median lifetime prevalence of sexual abuse among girls in Africa of 18.9%, in North America of 20.4%, and in Australia of 28.8%, with lower rates for boys [5]. Physical abuse rates were highest in African girls (50.8%) and boys (60.2%) and lowest in Europe, with 12% for girls and 27% for boys. Furthermore, the review revealed considerable variation in self-reported lifetime prevalence of ACEs among studies from the UK for physical abuse (3.6% to 32.6%), sexual abuse (0.7% to 27.8%), and emotional abuse (4% to 66.7%). Data on the prevalence of neglect is usually sparse, with substantial variation between studies [4,5]. Moody et al. [5] found that the prevalence of neglect varied between 5.6% to 77.8% in the UK, based on a small number of studies.

Numerous studies have shown that ACEs are strongly linked with objective measures of physical and mental health, as well as behavioural problems [1,2,6]. For instance, Felitti et al. [1] showed that individuals with four or more ACEs were more than twice as likely to have ischemic heart disease (adjusted odds ratio [AOR] = 2.2, 95% CI: 1.3–3.7) and stroke (AOR = 2.4, 95% CI: 1.3–4.3) than those with no ACEs. Similarly, the odds of suicide attempt and problematic drug use were 30.14 (14.73–61.67) and 10.22 (7.62–13.71) times higher in individuals with four or more ACEs compared to those with no ACEs, as estimated through a meta-analysis [2]. Additionally, unpredictable early life circumstances, such as unstable family environment and inconsistent parenting, were associated with a higher likelihood of non-suicidal self-injury [7]. Dose-dependent evidence further indicates that adolescents under 21 years of age exhibit higher rates of non-suicidal self-injury with an increasing number of ACEs [8].

Despite the well-documented links between ACEs and objective measures of health, little is known about how the effects of ACEs extend to subjective, self-rated health, reflecting individuals' own perspectives of their physical, mental, emotional, and social functioning. Subjective measures are considered an important complement to objec-

tive indicators of health, providing a more holistic view of health [9]. This is important because self-rated health is a significant predictor of mortality and morbidity, adjusting for objective measures of health [10]. Furthermore, improvements in objective measures of health do not always correspond to better day-to-day functioning, or vice versa [9]. Hence, it is recommended that care, research, and policy incorporate both objective and subjective measures of health [9,10,11].

An important subjective outcome measure used in health and social care research and economic evaluations is health-related quality of life (HRQoL). HRQoL is a preference-based, multidimensional (e.g., physical, psychological, social) measure of well-being that captures social functioning, role limitations, subjective evaluation of general health, and life satisfaction [12]. In economic studies, HRQoL is often treated as a proxy for 'utility'. Utility values for various health states are estimated from target populations' preferences using direct methods (e.g., standard gamble and time trade-off) or multi-attribute health status classification systems (e.g., EQ-5D-5L, SF-6D) [12,13,14]. The main use of utility values in economic evaluations is to construct quality-adjusted life years (QALYs). QALY is a summary measure of 'quality' and 'quantity' of life computed by weighting the length of life by utility values [12]. QALYs enable policymakers to compare across diverse healthcare areas. In England and Wales, the National Institute for Health and Care Excellence (NICE) values a QALY at between £20,000 (US \$27,000) and £30,000 (US \$40,500) [15]. However, the UK Treasury values a QALY at £60,000 (US \$81,000) [16].

When data on preference-based measures of health are unavailable in a study, non-preference-based measures can also be used to predict generic preference-based health-state utility values [17]. While the methods for obtaining health utilities for adults are well established, those for children and adolescents are still under development [18,19,20]. HRQoL in children is either self-rated or proxy rated (e.g., by parents) [21,22]. Validated generic preference-based multi-attribute health status classification systems for children and adolescents include Child Health Utility 9D (CHU9D), EQ-5D-Y, and Quality of Well-Being scale (QWB) [23]. When preference-based measures of quality of life have not been used in a particular study, a common approach is to map from other measures onto a preference-based measure when both have been used in a separate study [17].

Previous studies have investigated the association between ACEs and HRQoL in adults and adolescents [24,25,26] as well as other indicators of life satisfaction [27]. A systematic review showed an inverse relationship between child maltreatment and HRQoL among children and adult survivors [26]. Other recent studies report similar associations [24,25,28,29]. For instance, among adolescents aged 11 to 20, HRQoL, as measured by the Pae-

diatric Quality of Life Inventory, was lower among those reporting ACEs [30,31]. Furthermore, HRQoL progressively and significantly decreased with increasing number of ACEs, with reductions of 2.99 (one ACE), 6.05 (two ACEs), and 14.7 (three or more ACEs) units relative to no ACEs [31]. Additionally, Lo et al. [29] showed that poorer physical and emotional functioning in adolescents was specifically associated with psychological aggression and neglect, respectively. In contrast, impaired social functioning was affected by all three types of adversity: physical abuse, psychological abuse and neglect. A study that estimated quality-adjusted life expectancy (QALE) by weighting expected life years by HRQoL found that QALE decreased with increasing ACEs [32]. For an 18-year-old individual with no ACEs, QALE was estimated at 55.1 years, compared to 45.6 years for those with three or more ACEs [32]. Furthermore, ACEs were associated with lower positive functioning — happiness, optimism, connectedness, and perseverance — among adolescents [27].

Multiple mechanisms explain the relationship between ACEs and poor HRQoL, such as pathways involving poor mental health, behavioural risk, biological stress, and impaired sleep and functioning [2,33,34,35]. ACEs primarily affect HRQoL by influencing health-risk behaviours and chronic diseases [1,2], both of which contribute to reduced HRQoL. Exposure to four or more ACEs is particularly associated with greater odds of poor mental health, chronic diseases, smoking, and alcohol misuse, which are the main drivers of disability and reduced quality of life [1,2,36]. Chronic stress due to ACEs was also reported to have effects on neurobiological stress mechanisms, resulting in impairment of brain structure and function [33]. Additionally, adolescents with ACEs have sleep problems, which are partially mediated by depression and anxiety, which further contribute to reduced HRQoL [35].

In summary, the available research shows that ACEs are associated with poorer subjective health, with limited evidence on how these associations vary by the youth's sociodemographic characteristics. Using two UK cohort datasets, this study aims to assess the association of ACEs with HRQoL and QALYs. It also investigates the differential association of ACEs with HRQoL and QALYs by sex, ethnicity, and socioeconomic status (SES) of study participants, for which evidence is limited. The datasets used for the analyses differ in their sources of ACEs: self-report versus government-recorded. Different sources of ACEs data capture different subsets of adversity and introduce their own biases [37]. Usually, official records capture the most severe cases that come to official attention, whereas self-reports indicate broader subjective ACEs [37]. Recall bias in retrospective ACE reporting is associated with both under- and over-reporting [38,39], whereas official records often underestimate the prevalence of ACEs [4]. Various factors contribute to non-agreement between retrospective and prospective ACEs, such as intentional with-

holding or fabrication of information or measurement issues [37]. Therefore, populations with ACE self-reports and administrative data may have different experiences and risk mechanisms for the outcomes of interest [37,40].

Accordingly, the populations with ACE exposure in the two datasets used for this study are not directly comparable. Therefore, the study presents complementary analyses, though it answers the same questions to determine whether legally documented ACEs and broader self-reported ACE exposure show comparable associations with HRQoL/QALY. The use of the two datasets — with different sources of ACE data, covering different geographic areas, time periods, and ethnic composition of study participants — allows triangulation of findings, strengthening the evidence validity and generalisability.

## 2. Materials and Methods

Data were from two UK cohort studies: the Determinant of Adolescent Social well-being and Health (DASH) Study [41], and HeadStart Cornwall (HeadStart) [42]. The DASH survey was a longitudinal adolescent cohort study, with sampling concentrated in London boroughs with high ethnic minority populations [41,43]. It was conducted in three waves in 51 schools from 10 London boroughs. At baseline, 6648 students aged 11–13 years completed the survey in 2002/03. The first follow-up survey was conducted in 2005/06, during which 4785 students were retained, the focus of the current study [41]. The National Health Service Southeast Scotland Research Ethics Committee approved the study. Parents were informed about the study and given the option to have their child opt out. All participating adolescents also provided informed consent or assent prior to completing the questionnaires [43].

HeadStart was a cross-sectional and longitudinal survey of approximately 12,000 adolescents aged 11–16 years attending all state schools in Cornwall between 2017–2021 ([National Evaluation of HeadStart: Headstart Kernow](#)). For this study, we used the longitudinal data from waves 2017 and 2019 (age 13–14), with a baseline sample of 4575 Year 7 pupils. The baseline sample comprised 3786 respondents, of whom 2705 were retained in the 2019 follow-up. Cornwall consists of 96.8% of the population who identify as “White” in 2021 [44]. Ethical approval for HeadStart study was granted by the University College London Ethics Committee. Pupil assent and parental consent for HeadStart participation were obtained before data collection [45].

### 2.1 Measures

The dependent variables used in the analyses are HRQoL and QALYs. Neither DASH nor HeadStart used a preference-based utility measure. However, the studies included the self-report Strengths and Difficulties Questionnaire (SDQ) [46] administered at baseline and follow-up.

The SDQ is a behaviour and mental health screening and outcome questionnaire consisting of 25 questions with

three-option responses: 1 (not true), 2 (somewhat true), and 3 (certainly true). Higher values in each subscale indicate poorer functioning [47]. Utility values from the SDQ were derived via mapping onto the Child Health Utility 9D (CHU9D) measure [48,49]. The CHU9D is a multi-attribute utility instrument with nine domains (worried, sad, tired, annoyed, homework/schoolwork, sleep, daily routine, and activities) developed to estimate health-state utilities in children and adolescents [48]. The mapping algorithm was estimated using a generalized linear model (GLM) with a power link ( $\lambda = 2$ ) [49]. The utility values range from 1 (full health) to 0 (death). While HRQoL solely measures the quality of life, QALYs combine the ‘quality’ and ‘quantity’ of life into a single index. In QALYs, a year lived with perfect health is assumed to be worth one QALY, and a year of life lived with less than perfect health is assumed to be worth less than one QALY [13]. QALYs are estimated using an ‘area under the curve’ (AUC) approach, assuming linear change over time [50]. The average utility values at baseline and follow-up are weighted by duration of follow-up, specifically 3 years for DASH and 2 years for HeadStart.

ACE is the main independent variable of interest. However, there is a considerable difference in the measurement of ACEs in the two datasets. DASH includes various measures of self-reported ACEs: being placed in foster care, parental divorce/separation, parental death, parental mental health problem or cancer and ‘hassle’ endured by the respondents due to race, language, and/or looks (**Supplementary Table 1**). These variables were binary, indicating the occurrence (or non-occurrence) of the adversities. A count variable indicating the number of ACEs experienced was created by summing the raw counts of these adversities. Furthermore, a binary variable indicating the presence of the ACEs was generated.

The HeadStart data include one variable indicating whether ACEs are present (‘on family list’). Being on the family list indicates whether the respondent’s family (the child or the parent) was receiving support from local government through the Supporting Families Program [51]. Families are listed on this program if they experience adversities due to sexual exploitation, crime, homelessness, domestic violence, unemployment, or physical and/or mental illness in the household. Data on the types of adversities experienced are not available. Because the two datasets measure distinct constructs of ACEs — retrospective self-report and prospective official records — analyses and findings are presented separately. This approach facilitates the assessment of consistency or differences in associations across ACE sources.

Other characteristics of interest are sex, ethnicity, and socioeconomic status (SES). In HeadStart data, SES was indicated by eligibility for free school meals (FSM) [52]. Based on the FSM criteria, the respondents were categorised as poor (10.07%) or non-poor (89.93%) in 2017. In the DASH data, household asset ownership

(**Supplementary Table 2**) was used to generate an asset index using multiple correspondence analysis (MCA) [53], which was then used to measure SES. For a comparative analysis, respondents in the lowest 10% of the asset index (firststdecile) were categorised as poor, and the rest as non-poor. Additionally, a continuous asset index was used in a separate analysis. HeadStart includes a binary ethnicity variable (White vs non-White). To maintain comparability across datasets and simplify analyses, ethnicity in the DASH data was also grouped in the same way, even though more detailed ethnic classifications were originally available in DASH.

## 2.2 Data Analysis

DASH and HeadStart data were analysed separately. Descriptive statistics is reported for the observed data using frequencies (percentages) for categorical variables and means (standard deviation (SD)) for quantitative variables.

Multivariable regression of the follow-up total SDQ score showed that dropout was highly significantly associated with baseline total SDQ score, gender, and race/ethnicity ( $p = 0.000$ ), whereas self-reported ACEs and SES did not predict dropout in the DASH data. Respondents with higher SDQ scores, females, and White participants were more likely to drop out. In contrast, being on the Family List — a record of ACEs from government administrative data — was the only significant predictor of dropout in HeadStart data (**Supplementary Table 3**). These findings suggest that the Missing At Random (MAR) assumption is plausible. Therefore, these covariates were included when imputing missing data in the datasets. Missing data were imputed using Multiple Imputation by Chained Equations (MICE) in Stata 18 [54,55,56]. 50 imputed datasets (with 10 iterations per imputation) were generated for each dataset. The imputation method was determined based on the measurement type of each variable (i.e., predictive mean matching for continuous and count data and logistic for binary variables). The number of missing values imputed for each variable is reported in the (**Supplementary Table 4**). Imputation convergence and the plausibility of imputed data were assessed by examining Monte Carlo errors [56] and comparing the observed and imputed data. Monte Carlo errors for the estimated coefficients were considered acceptable if they were less than 10% of the standard errors of the coefficients, indicating an adequate number of imputations [56].

Utility scores and QALYs were generated using the mapping algorithm [49] with passive imputation within each imputed dataset. The predictive performance of the mapping algorithm was assessed across multiple imputed datasets through visual inspection of histograms of predicted utilities, analyses of summary statistics, and examination of ceiling and floor effects. Furthermore, the association between the predicted utilities and total SDQ was examined using bivariate analysis. The final analysis models

were also estimated using total SDQ as a dependent variable for triangulation. All analyses were conducted separately on each imputed dataset, and the results were pooled according to Rubin's method [57]. For comparative analysis, ACEs were included as dummy variables in each dataset. Further analyses of the graded effect of ACEs were conducted using a multi-category ACE variable (none, one, two, three or more) in the DASH data. Interaction terms were included in all models for both datasets, specifically for (i) ACEs × SES and (ii) ACEs × sex. An additional ACEs × ethnicity interaction was examined only in the DASH dataset, as the HeadStart sample contained limited ethnic variation (only 2.38% identified as non-White). The supplementary DASH analyses also incorporated a continuous asset index measure.

### 2.3 Sensitivity Analysis

Sensitivity analysis was conducted using inverse probability weighting (IPW) to assess the robustness of the association between ACEs and HRQoL and QALYs to potential confounding [58,59]. IPW analysis was conducted within the imputed datasets. Propensity scores indicating

the probability of exposure to ACEs were estimated, adjusting for gender, race/ethnicity, and SES. Inverse probability weights were then used to estimate the average treatment effect on the treated (ATET) among ACE-exposed individuals. ATET shows how much outcomes differ for individuals exposed to ACEs compared with what their outcome would likely have been if they were not exposed to ACEs. IPW-weighted regression models were estimated within each imputed dataset, and estimates were pooled across imputations using Rubin's rules [57]. Because the IPW analysis aimed to assess the robustness of the overall associations to confounding, interaction terms were not included in the sensitivity analyses models.

## 3. Results

### 3.1 Descriptive Statistics

The average age of the respondents was 12.60 (SD: 0.62) (DASH) and 11–12 years (HeadStart). The two surveys had a similar sex composition, both with a slightly higher proportion of male respondents. Ethnic composition differed significantly: 29.59% White in DASH ver-

**Table 1. Demographic characteristics DASH (2002/03) and HeadStart (2017) respondents at baseline.**

	DASH		HeadStart	
	N/Mean	%/Std. dev	N/Mean	%/Std. dev
Age (mean, SD) <sup>a</sup>	12.600	0.620		
<b>Sex</b>				
Male	3535	53.350	2168	51.040
Female	3091	46.650	2080	48.960
<b>Ethnicity</b>				
White	1962	29.590	4110	97.620
Non-White	4669	70.410	100	2.380
<b>ACEs</b>				
Administrative data				
Has official record of ACEs			531	12.440
No official record of ACEs			3738	87.560
Self-report				
One or more ACEs	3718	59.230		
No ACEs	2559	40.770		
One ACE	2149	34.230		
Two ACEs	1031	16.430		
Three or more ACEs	538	8.570		
ACE count (mean, Std. Dev)	0.949	1.011		
<b>Socioeconomic status</b>				
From non-poor households	5612	89.99	3839	89.930
From poor households	624	10.01	430	10.070
<b>HRQoL / QALYs (mean<sup>b</sup>, SE)</b>				
Baseline HRQoL	0.791	0.001	0.743	0.002
Follow-up HRQoL	0.746	0.001	0.712	0.002
QALYs	2.330	0.002	1.450	0.004

<sup>a</sup>There was no age data for HeadStart survey respondents. Respondents were Year 7 pupils with an average age of 11–12. <sup>b</sup>Pooled mean estimate after multiple imputation. ACEs, adverse childhood experiences; HRQoL, health-related quality of life; QALYs, quality-adjusted life years.

sus 97.62% in HeadStart. The proportion of DASH respondents with self-reported ACEs (59.23%) was much higher compared to the official record of ACEs in HeadStart (12.44%). Average HRQoL reduced between baseline and follow-up surveys in both datasets. On average, respondents accumulated 2.33 (SE: 0.002) (DASH) and 1.45 (SE: 0.004) (HeadStart) QALYs over the 3-year and 2-year follow-up periods, respectively, which indicate losses of 0.67 (DASH) and 0.55 (HeadStart) QALYs (Table 1)

### 3.2 Robustness Analyses

The robustness assessment of the multiple imputation indicated no evidence of non-convergence, as coefficients remained stable across iterations and Monte Carlo errors of the estimates were less than 10% their corresponding standard errors [56] (Supplementary Table 5). Similarly, results of the robustness analysis of the mapping algorithm showed that predicted utilities vary within the feasible range of 0 and 1 and displayed a left-skewed distribution, as expected, with consistent ceiling (>0.95) and floor (<0.3) effects (Supplementary Fig. 1). The pooled mean utilities at baseline and follow-up were, respectively, 0.791 (SE: 0.001) and 0.746 (SE: 0.001) in DASH and 0.743 (SE: 0.001) and 0.711 (SE: 0.002) in HeadStart. These estimates were comparable with those (0.798; SD: 0.12) reported by Sharma et al. [49]. The mean utility values were also consistent with estimates of utility in the UK child and adolescent population [60]. Furthermore, bivariate regressions showed a highly significant negative association between the predicted utilities and total SDQ in both datasets. Mean utilities decreased monotonically as the severity of SDQ increased (Supplementary Tables 6–8). These results of ro-

business assessment suggest that the mapping of the SDQ to CHU9D was plausible.

### 3.3 Association of Occurrence of ACEs With HRQoL and QALYs

Overall, the occurrence of ACEs — exposure to any ACEs compared to none — predicted lower HRQoL as measured by both self-reported and official records of ACEs, adjusting for sex, SES, and ethnicity (Table 2). On average, the HRQoL of DASH respondents who self-reported ACEs was 0.031 (SE = 0.009) lower than that of their peers without ACEs at baseline, and 0.030 (SE = 0.009) lower at follow-up. Reductions in HRQoL were slightly higher at baseline, using the official ACE record (−0.046, SE = 0.012). Females had significantly impaired QALYs and lower HRQoL in both surveys. Ethnicity significantly predicted HRQoL and QALY in DASH data but not in HeadStart data. QALYs were on average −0.064 (SE = 0.021) and −0.060 (SE = 0.021) lower, respectively, using self-report and official records of ACEs in reference to no ACEs. This is equivalent to losses of about 23 (DASH) and 22 (HeadStart) days over the three- and two-year follow-up period. The interactions between ACEs and sex resulted in inconsistent estimates on utilities but a significant reduction of QALYs in females compared to males. The interaction between ACEs and SES was insignificant in either dataset.

### 3.4 Graded Association of ACEs With HRQoL and QALYs

HRQoL and QALYs declined significantly with increasing ACE counts, indicating a dose-dependent (graded) effect (Table 3). On average, baseline HRQoL was −0.011 (SE = 0.004), −0.031 (SE = 0.006), and −0.063 (SE = 0.007) in respondents with one, two, and three or more

**Table 2. Multiple imputation estimates of predictors of health-related quality of life (HRQoL) and baseline predictors of quality-adjusted life-years (QALYs) in DASH and HeadStart respondents.**

	HRQoL				QALYs	
	DASH		HeadStart		DASH	HeadStart
	2002/03	2004/2005	2017	2019	2002/03–2005/06	2017–2019
	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
<b>Main effects</b>						
<b>ACEs</b>						
Administrative data			−0.046 (0.012)***	−0.015 (0.014)		−0.060 (0.021)***
Self-report	−0.031 (0.009)***	−0.030 (0.009)***			−0.064 (0.021)***	
Female	−0.036 (0.004)***	−0.075 (0.004)***	−0.041 (0.004)***	−0.093 (0.005)***	−0.162 (0.010)***	−0.133 (0.008)***
Non poor	0.014 (0.007)**	0.009 (0.008)	0.019 (0.007)***	0.031 (0.009)***	0.042 (0.018)**	0.051 (0.013)***
White	−0.012 (0.003)***	−0.010 (0.003)***	−0.009 (0.011)	−0.021 (0.013)	−0.030 (0.007)***	−0.029 (0.020)
<b>Interactions</b>						
Female and ACEs	−0.014 (0.005)***	0.002 (0.005)	−0.022 (0.011)*	−0.038 (0.014)***	−0.028 (0.013)**	−0.060 (0.021)***
Non poor and ACEs	0.004 (0.009)	0.005 (0.100)	0.006 (0.013)	−0.025 (0.015)	0.003 (0.022)	−0.019 (0.023)
Constant	0.819 (0.007)***	0.790 (0.008)***	0.763 (0.013)***	0.757 (0.015)***	2.400 (0.017)***	1.520 (0.024)***
Number of imputations	50		50		50	50
Number of observations	6648		4575		6648	4575

\*\*\*, \*\*, and \* indicate significance at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. Unstandardised coefficients. The coefficient estimates of QALYs represent the total cumulative change in QALYs over the entire follow-up period—3 years for DASH and 2 years for HeadStart.

**Table 3. Multiple imputation analysis of dose-dependent relationships between ACEs and HRQoL and QALYs in the DASH sample.**

	HRQoL 2002/03	HRQoL 2004/05	QALYs
	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
<b>Main effects</b>			
Self-reported number of ACEs (ref. none)			
One	-0.011 (0.004)**	-0.018 (0.004)***	-0.015 (0.025)
Two	-0.031 (0.006)***	-0.034 (0.006)***	-0.067 (0.032)**
Three or more	-0.063 (0.007)***	-0.057 (0.009)***	-0.149 (0.036)***
Female	-0.036 (0.004)***	-0.075 (0.004)***	-0.161 (0.010)***
Asset index	0.005 (0.002)***	0.001 (0.002)	0.041 (0.003)**
White	-0.006 (0.004)	-0.011 (0.004)***	-0.011 (0.011)
<b>Interactions</b>			
<i>Ethnicity and ACEs</i>			
White and one ACEs	-0.008 (0.006)	0.004 (0.006)	-0.027 (0.015)*
White and two ACEs	-0.021 (0.008)***	-0.008 (0.009)	-0.047 (0.019)**
White and three or more ACEs	-0.024 (0.011)**	0.004 (0.015)	-0.064 (0.027)**
<i>Asset index and ACEs</i>			
Asset index and one ACE	0.001 (0.003)	-0.001 (0.003)	-0.004 (0.024)
Asset index and two ACEs	-0.005 (0.004)	0.002 (0.003)	-0.009 (0.032)
Asset index and three or more ACEs	-0.002 (0.004)	-0.007 (0.006)	-0.018 (0.037)
<i>Gender and ACEs</i>			
Female and one ACE	-0.008 (0.006)	0.004 (0.006)	-0.013 (0.014)
Female and two ACEs	-0.021 (0.008)***	0.005 (0.008)	-0.038 (0.019)**
Female and three or more ACEs	-0.022 (0.010)**	-0.016 (0.012)	-0.056 (0.024)**
Constant	0.830 (0.003)***	0.799 (0.003)***	2.39 (0.018)***
Number of observations	6648		
Number of imputations	50		

\*\*\*, \*\*, and \* indicate significance at  $p < 0.01$ ,  $p < 0.05$ , and  $p < 0.1$ , respectively. The coefficient estimates of QALYs represent the total cumulative change in QALYs over the entire follow-up period—3 years for DASH and 2 years for HeadStart.

ACEs, respectively, compared to those with no ACEs. Over the follow-up period, respondents with two (-0.067, SE = 0.032) and three or more (-0.149, SE = 0.036) ACEs accrued fewer QALYs, on average, compared to the non-exposed respondents. These translate to losses of 24 days and 54 days over the three-year follow-up period, respectively. Additionally, ACEs had a greater effect on HRQoL (baseline) and QALYs among White adolescents, with the magnitude of association increasing with a greater number of exposures. A dose-dependent interaction of ACEs and gender was observed at higher levels of ACEs (2+ ACEs). The dose-dependent interactions between ACEs and SES were inconclusive.

### 3.5 Sensitivity Analyses

The unweighted regression model in DASH data, without interaction terms, showed that self-reported ACE exposure lowered QALYs on average by 0.074 (SE = 0.006). Sensitivity analyses with inverse probability weighting also showed that QALYs were, on average, lower by 0.075 (SE = 0.006) among adolescents who experienced ACEs than they would likely be if they were not exposed to ACEs. Similarly, in the official ACEs record, both un-

weighted and inverse-probability-weighted regressions for QALY produced nearly identical results. Results of IPW-weighted regressions of baseline and follow-up utilities also showed strong consistency with the unweighted estimates (Table 4). These results suggest that the association between ACEs and HRQoL/QALYs were robust to confounding adjustment.

## 4. Discussion

This study examined the association between ACEs and both HRQoL and QALYs in two UK adolescent cohort surveys that differed in ACE data source, geographic region, time period, and ethnic composition, thereby contributing to growing evidence on how ACEs affect the multidimensional wellbeing of adolescents. It also assessed whether these associations varied by sex, ethnicity, and SES. Both self-report and government-recorded ACEs were associated with lower HRQoL and fewer QALYs, with stronger negative effects as the number of ACEs increased, demonstrating a dose-dependent relationship. Additionally, graded interaction between ACEs and both ethnicity and gender was identified for QALYs.

**Table 4. Sensitivity analyses of association between ACEs and QALYs/HRQoL using inverse probability weighting.**

	DASH (self-reported ACEs)			HeadStart (official record of ACEs)		
	Effect of ACEs	SE	<i>p</i>	Effect of ACEs	SE	<i>p</i>
QALYs						
Unweighted regression	-0.074	0.006	0.000	-0.101	0.012	0.000
IPW weighted regression - ATET	-0.075	0.006	0.000	-0.098	0.013	0.000
Counterfactual mean (no ACEs)	2.346	0.004	0.000	1.452	0.008	0.000
Follow-up utility						
Unweighted regression	-0.015	0.003	0.000	-0.048	0.008	0.000
IPW weighted regression - ATET	-0.016	0.003	0.000	-0.045	0.009	0.000
Counterfactual mean (no ACEs)	0.753	0.002	0.000	0.708	0.005	0.000
Baseline utility						
Unweighted regression	-0.034	0.003	0.000	-0.053	0.006	0.000
IPW weighted regression - ATET	-0.035	0.003	0.000	-0.053	0.007	0.000
Counterfactual mean (no ACEs)	0.811	0.002	0.000	0.744	0.004	0.000

Notes: ATET, average treatment effect on treated.

HRQoL declined between baseline and the follow-up surveys (2–3 years later) in both groups of respondents, regardless of ACEs. However, adolescents with ACE exposures — both from self-report and official records — generally demonstrated lower HRQoL and accrued fewer QALYs compared to adolescents not exposed to ACEs. These findings align with previous evidence synthesised in a systematic review that reported significant negative associations for both self-reported and proxy-rated HRQoL [26]. Furthermore, direct and indirect exposure to violence was found to be associated with HRQoL compared to other adverse life events not involving victimisation [61]. However, disagreement in the association between ACEs and HRQoL, depending on whether HRQoL was self-reported or proxy-rated, was also reported [62,63]. For instance, a study with children and adolescents in Germany found non-significant effects of ACEs on self-rated HRQoL, whereas proxy-rated HRQoL was lower among maltreated children [63]. In contrast, Jud et al. [62] found significantly impaired self-reported HRQoL but not caregiver-rated HRQoL in maltreated children. Discordance between self-rated and proxy-rated HRQoL is common, likely reflecting differences in perceptions of children’s experiences between children and proxies [64]. Therefore, this discordance should be taken into account when interpreting evidence of associations between ACEs and HRQoL.

HRQoL was significantly reduced in females compared to males in the follow-up surveys, suggesting that sex-related differences in HRQoL emerge as adolescents get older. Given respondents’ baseline age (average of 12 years), reduced HRQoL over time may be explained by a continuous decrease in life satisfaction (LS) in adolescents, beginning around 11 years of age [65]. This aligns with the broad literature showing that LS is generally lower in adolescence compared to pre-adolescence and childhood, with adolescence associated with increased emotional and psychological vulnerability, particularly among girls [65,66,67]. The lowest average LS was reported

among 15-year-olds in the UK compared with those in 27 European countries, where one in five (male) and almost one in three (female) reported low LS [68].

Although the evidence of gender or sex differences in LS and social inequality in LS remains inconsistent [67,69], numerous studies show that females generally report lower quality of life [70,71,72]. Notably, the LS gap between adolescent boys and girls is larger in countries with greater gender equality — a phenomenon referred to as the gender-equality paradox [73,74]. Several empirical studies attribute lower LS in adolescent girls to biological, psychological, emotional, and social factors [75,76,77], including earlier maturation, heightened sensitivity to stress and hormonal changes [78], increased levels of negative emotions [79], and reduced self-esteem [80]. For instance, early puberty in girls is associated with stress and body dissatisfaction [81], which is exacerbated by strong societal and media pressures of standards of beauty, body image, and appearance, which lowers the self-esteem of girls [82]. Additionally, cultural and structural inequalities heighten concerns about safety and security among girls, restricting their participation in public spaces and limiting their opportunities [83,84]. Girls are also expected to conform to gender norms and role expectations, which further contribute to stress among girls [85,86].

Other studies, while acknowledging some of these factors, argue that some of these explanations do not account for variations in findings across countries and the gender-equality paradox. These studies argue that broader social and contextual factors, including macroeconomic conditions, play a more significant role in explaining the gender gap in LS [74,87,88]. For example, international studies [74,88,89] found that LS is lower among girls, with the difference greater in more gender-equal countries. Brisson et al. [87] demonstrated that the effect of gender on LS is confounded by other factors influencing LS, and that this effect diminished when these confounders were accounted for. After adjusting for confounders, LS was found to be

higher among girls in Kazakhstan, contrary to the result in Luxembourg [73], where LS was higher in boys. Similarly, Eriksson and Strimling [88] reported that 40% of the gender effect on LS was mediated by countries' gender equality indices. Although the evidence on the gender-equality paradox is still evolving, plausible explanations for the paradox include increased awareness of discrimination against females and greater gender comparisons in countries with greater gender equality, which undermine the progress in gender equality and contribute to lower LS [74].

SES is another household-level determinant of HRQoL and QALYs among adolescents; however, the results should be interpreted cautiously due to measurement issues. First, the measurement of SES in the two datasets varies and is primarily based on financial or material resources. In DASH data, SES was measured using an asset index generated from household assets (e.g., cars, TVs, etc.). Asset indices as measures of SES have limitations, such as the inability to capture current income or consumption and limited comparability due to variation in asset holdings [90,91]. In HeadStart, SES was measured based on eligibility for free school meals (FSM). The eligibility criteria for FSM include, among others, household income below a threshold, receipt of income support, employment support, or other government allowances ([Free meals in further education funded institutions guide: academic year 2025 to 2026 - GOV.UK](#)). Hence, the SES index in this study is a partial measure of SES. In fact, while 'socioeconomic status' and 'socioeconomic position' (SEP) are used interchangeably [92], SEP was suggested as a better term indicating resource-based (e.g. income, education) and prestige-based (status in a social hierarchy) status that are measured at individual, household, and neighbourhood levels, such as education, occupational prestige, housing, neighbourhood deprivation [93]. However, measurement of SES remains inconsistent across studies and is limited to a few or a single indicator [94]. Second, the binary SES indicator in this study does not fully capture the full gradient, with 10% categorised as poor and 90% as non-poor. This limits statistical power and precision of regression estimates [95].

Taking the foregoing into account, the HeadStart data showed a strong association between exposure to ACEs and poorer HRQoL and QALYs, whereas the effect of SES in the DASH data was inconsistent. This may partly reflect differences in how SES was measured, as eligibility for FSM is based on means testing and therefore captures current SES more accurately than asset ownership in DASH, which may not fully represent current SES. Previous studies [62,63] also showed that adolescents from low SES households have reduced HRQoL and QALYs compared to those from high SES households. A multi-country study across seven European countries showed a stable SES gradient in adolescent HRQoL (using parental education and material wealth), with material wealth being more important during

adolescence [96]. Another study estimated that lower quality of life was 1.12 times higher in the poorest quintiles (as measured by asset ownership) than in the richest quintile adolescents in Iran [70]. This was supported by a systematic review that showed that adolescents with low SES (income, housing, ownership of household durable assets, utilities) are at a higher risk of behavioural problems (e.g., low physical activity, consumption of high energy-dense food) [97], which is related to poorer HRQoL [98]. Higher burden of physical and mental illnesses and access barriers to care are other factors that explain impaired quality of life in the population with lower SES [99,100].

Ethnicity is among the factors that influence HRQoL and QALY, although the evidence is limited and inconsistent [101,102]. In this study, HRQoL and QALYs were lower in White ethnicity adolescents compared to 'other ethnicity' in DASH data. These findings are contrary to some studies among adolescents in the USA [101]. However, some studies in adolescent mental health in the UK found similar results with better mental health reported among ethnic minorities [43,103], although contrasting evidence is also available [104]. Inequalities in HRQoL to the disadvantage of ethnic minorities was also reported among older population in England [105]. There was no evidence of a significant association between ethnicity and HRQoL or QALYs in the HeadStart data. This may be explained by a lack of power to detect differences due to limited variability within ethnicity in the study sample, with ethnicity composition of 2.38% (non-White) and 97.62% (White).

In addition to the main effects analyses discussed above, this study included interaction analyses to further examine the moderation of the association of ACEs with HRQoL and QALYs by characteristics of the study population. A small body of literature shows that there are differences in the distribution of ACEs and in the effect of ACEs on population wellbeing. For instance, it is reported that ACEs are disproportionately prevalent among marginalised populations such as women, ethnic minorities, low SES, and less educated populations [3]. Furthermore, significant inequalities in ACEs scores across the intersections of sex and SES have been reported [106,107], with the highest ACE scores observed in multiracial female adolescents from low-income households, followed by low-income multiracial male adolescents (12–17 years of age) in the US [106]. This study also showed a higher prevalence of ACEs among non-White females and the poor (**Supplementary Table 9**).

While some studies assessed how patient characteristics moderate the link between ACEs and mental health [108,109,110], moderation analyses in HRQoL and QALYs are limited [29,30]. In this study, interaction term analyses generally produced inconsistent results, particularly in the follow-up surveys, which showed no statistically significant moderation. However, analysis of DASH data suggests a dose-dependent interaction between ACEs and eth-

nicity and gender (2+ ACEs) for the baseline HRQoL and QALYs. White respondents typically had lower HRQoL and QALYs, and this gap widened for those with a greater number of ACEs compared to all other ethnicity–ACE groups. Similarly, the dose-dependent ACEs-gender interaction showed a significant association, only for the interaction of gender with two and three or more counts of ACEs. However, none of the ACE-SES interactions was significant. Inconsistent moderation by gender and ethnicity, or the absence of moderation by SES, may suggest that ACEs were uniformly associated with HRQoL and/or QALYs across different sociodemographic characteristics. Although females and the poor were more likely to experience ACEs (**Supplementary Table 9**), once exposed, the detrimental effects of ACEs appeared consistent across all groups. Therefore, while targeted prevention policies can address unequal exposure to ACEs, universal policies, such as school-based trauma-informed care, are needed to mitigate the effects of ACEs on the exposed. Non-significant or inconsistent interaction effects do not necessarily imply a lack of moderation but may reflect methodological limitations, such as insufficient statistical power or measurement issues. This is an area of research that needs further investigation with higher-quality data and rigorous analytic methods.

### *Limitations*

The study findings have some limitations that should be considered. First, although the study used longitudinal adolescent surveys, there were differences in the ethnic profiles of respondents and the type and measures of ACEs and SES across the two datasets. While binary ethnicity was available in the HeadStart data, DASH data had multicategory ethnicity. We have collapsed the ethnicity categories in DASH data into two to align with the HeadStart data. While this categorisation simplifies analyses, we acknowledge that it may have introduced bias by masking variation in HRQoL and/or QALYs across different ethnic groups [111,112,113]. For instance, Lam [113] reported that, granular ethnicity categorisation identified meaningful differences and inequities in experiences of racism compared to coarse categories. Therefore, future studies may explore granular and intentional categorisation of race/ethnicity to assess its association with HRQoL/QALYs and whether the association between ACEs and HRQoL/QALYs is moderated by race/ethnicity. In terms of SES, the HeadStart data had a single variable indicating the presence or absence of ACEs based on official Supporting Families Program data, while the DASH data included eight categories of adversity based on self-report data. Different methods of data collection about ACEs are problematic because official reports usually under-estimate ACEs [4]. This is evident in the HeadStart data, which showed only 12% prevalence of ACEs, compared to 59% in the DASH data. Furthermore, the binary nature of the ACE variable in the HeadStart data

limited the analysis of the potential graded effects of ACEs, which is shown in the DASH data. Second, HRQoL was predicted by mapping SDQ using a statistical mapping algorithm [49]; any prediction inaccuracy may have biased the results. Third, the data sources did not specify whether the variable sex represents biological sex or gender identity; we have assumed it represents gender, and this may have affected interpretations of study findings. These limitations notwithstanding, large sample sizes with varied population groups suggest the findings of the study may be generalisable to adolescents (11–17 years old) in the UK.

## **5. Conclusions**

This study adds to a sparse literature base showing that the effects of ACEs extend beyond biomedical morbidity in young people, reducing subjective multidimensional health, as reflected in HRQoL and QALYs. Exposure to ACEs, both self-reported and government-recorded, is associated with lower HRQoL and greater QALY losses, with the strength of association increasing as the number of ACEs increases. Furthermore, adolescents with White ethnicity have relatively larger QALY losses compared to other ethnicities. Older female adolescents also have lower QALYs than their counterparts. These findings suggest that the effect of ACEs on HRQoL and QALYs differs by adolescents' background characteristics, and warrant additional investigation of the pathways of effect, including more detailed and granular ethnic classifications and more robust, high-quality measures of SES, to inform policies that reduce inequalities. The findings also suggest better targeting of preventive interventions with universal mitigation interventions for ACEs and ACE-related health problems, guided by how impacts vary across different populations.

### **Availability of Data and Materials**

The HeadStart data are available for secondary analysis through the UK Data Service. DASH data are available to researchers upon request to [seeromanie.harding@kcl.ac.uk](mailto:seeromanie.harding@kcl.ac.uk).

### **Author Contributions**

Funding Acquisition: KB, PMc.; Conceptualisation: AO, PMc; Methodology: AO, PMc; Formal Analysis, AO; Data Curation, AK, SH, AO, PMc; Writing—Original Draft Preparation, AO; Writing—Interpretation of Findings - KB, LH, SS, GH, SH-J., MM, and A.M-W; Critical Review, Editing and Revision, AO, KB, LH, SS, GH, SH-J, MM, AM-W, AK, SH, PMc. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

## Ethics Approval and Consent to Participate

Not applicable.

## Acknowledgment

We acknowledge the invaluable support of participants and their parents, the Participant Advisory Group, schools, civic leaders, local GP surgeries and community pharmacies, the Clinical Research Centre at Queen Mary University of London, the Clinical Research Facility at University College Hospital, the survey assistants and nurses involved in DASH data collection. We acknowledge the HeadStart programme team and The National Lottery Community Fund for making the HeadStart data publicly available. We thank Professor Mina Fazel for helpful comments on earlier versions of this manuscript.

## Funding

This work was supported by the UK Research and Innovation [UKRI] award (MR/W002183/1). The DASH study was funded by the Medical Research Council (10.13039/N4501100000265, MC\_U130015185/MC\_UU\_12017/1/MC\_UU\_12017/13), North Central London Consortium, and the Primary Care Research Network. HeadStart was funded by The National Lottery Community Fund.

## Conflicts of Interest

The authors declare no conflicts of interest.

## Supplementary Material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.31083/AP49284>.

## References

- [1] 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. [https://doi.org/10.1016/s0749-3797\(98\)00017-8](https://doi.org/10.1016/s0749-3797(98)00017-8)
- [2] 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. *The Lancet. Public Health*. 2017; 2: e356–e366. [https://doi.org/10.1016/S2468-2667\(17\)30118-4](https://doi.org/10.1016/S2468-2667(17)30118-4)
- [3] Cronholm PF, Forke CM, Wade R, Bair-Merritt MH, Davis M, Harkins-Schwarz M, et al. Adverse Childhood Experiences: Expanding the Concept of Adversity. *American Journal of Preventive Medicine*. 2015; 49: 354–361. <https://doi.org/10.1016/j.amepre.2015.02.001>
- [4] Stoltenborgh M, Bakermans-Kranenburg MJ, Alink LRA, van IJzendoorn MH. The Prevalence of Child Maltreatment across the Globe: Review of a Series of Meta-Analyses. *Child Abuse Review*. 2015; 24: 37–50. <https://doi.org/10.1002/car.2353>
- [5] Moody G, Cannings-John R, Hood K, Kemp A, Robling M. Establishing the international prevalence of self-reported child maltreatment: a systematic review by maltreatment type and gender. *BMC Public Health*. 2018; 18: 1164. <https://doi.org/10.1186/s12889-018-6044-y>
- [6] Petrucci K, Davis J, Berman T. Adverse childhood experiences and associated health outcomes: A systematic review and meta-analysis. *Child Abuse & Neglect*. 2019; 97: 104127. <https://doi.org/10.1016/j.chiabu.2019.104127>
- [7] Zhang J, Wang E. Early life environmental unpredictability shapes non-suicidal self-injury: dual roles of experiential avoidance as mediator and moderator in Chinese college students. *BMC Psychology*. 2025; 13: 670. <https://doi.org/10.1186/s40359-025-02986-5>
- [8] Suhail Usmani S, Mehendale M, Yousif Shaikh M, Sudan S, Guntipalli P, Ouellette L, et al. Understanding the Impact of Adverse Childhood Experiences on Non-suicidal Self-Injury in Youth: A Systematic Review. *Alpha Psychiatry*. 2024; 25: 150–164. <https://doi.org/10.5152/alphapsychiatry.2024.231139>
- [9] Guyatt GH, Feeny DH, Patrick DL. Measuring health-related quality of life. *Annals of Internal Medicine*. 1993; 118: 622–629. <https://doi.org/10.7326/0003-4819-118-8-199304150-00009>
- [10] Benyamini Y. Why does self-rated health predict mortality? An update on current knowledge and a research agenda for psychologists. *Psychology & Health*. 2011; 26: 1407–1413. <https://doi.org/10.1080/08870446.2011.621703>
- [11] Testa MA, Simonson DC. Assessment of quality-of-life outcomes. *The New England Journal of Medicine*. 1996; 334: 835–840. <https://doi.org/10.1056/NEJM199603283341306>
- [12] Whitehead SJ, Ali S. Health outcomes in economic evaluation: the QALY and utilities. *British Medical Bulletin*. 2010; 96: 5–21. <https://doi.org/10.1093/bmb/ldq033>
- [13] Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. *Methods for the economic evaluation of health care programmes*. 3rd edn. Oxford university press: Oxford. 2015.
- [14] EuroQol Group. EQ-5D-3L. 2025. Available at: [https://euroqol.org/information-and-support/euroqol-instruments/eq-5d-3l/?utm\\_source=chatgpt.com](https://euroqol.org/information-and-support/euroqol-instruments/eq-5d-3l/?utm_source=chatgpt.com) (Accessed: 23 May 2025).
- [15] National Institute for Health and Care Excellence (NICE). *Guide to the Methods of Technology Appraisal* 2013. London: NICE; 2013. Available at: <https://www.nice.org.uk/process/pmg9/resources/guide-to-the-methods-of-technology-appraisal-2013-pdf-2007975843781> (Accessed: 23 May 2025).
- [16] HM Treasury. *The Green Book: appraisal and evaluation in central government*. Kew: London. 2022.
- [17] Brazier JE, Yang Y, Tsuchiya A, Rowen DL. A review of studies mapping (or cross walking) non-preference based measures of health to generic preference-based measures. *The European Journal of Health Economics* : HEPAC : Health Economics in Prevention and Care. 2010; 11: 215–225. <https://doi.org/10.1007/s10198-009-0168-z>
- [18] Kelly CB, Soley-Bori M, Lingam R, Forman J, Cecil L, Newham J, et al. Mapping PedsQL™ scores to CHU9D utility weights for children with chronic conditions in a multi-ethnic and deprived metropolitan population. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2023; 32: 1909–1923. <https://doi.org/10.1007/s11136-023-03359-4>
- [19] Thorrington D, Eames K. Measuring Health Utilities in Children and Adolescents: A Systematic Review of the Literature. *PloS One*. 2015; 10: e0135672. <https://doi.org/10.1371/journal.pone.0135672>
- [20] Rowen D, Rivero-Arias O, Devlin N, Ratcliffe J. Review of Valuation Methods of Preference-Based Measures of Health for Economic Evaluation in Child and Adolescent Populations: Where are We Now and Where are We Going? *Phar-*

- macoEconomics. 2020; 38: 325–340. <https://doi.org/10.1007/s40273-019-00873-7>
- [21] Tain YL, Lu PC, Kuo HC, Hsu CN. Differences in health-related quality of life in children with chronic kidney disease as reported by children and parent proxies. *Pediatric Nephrology* (Berlin, Germany). 2023; 38: 519–528. <https://doi.org/10.1007/s00467-022-05621-2>
- [22] Dey M, Landolt MA, Mohler-Kuo M. Assessing parent-child agreement in health-related quality of life among three health status groups. *Social Psychiatry and Psychiatric Epidemiology*. 2013; 48: 503–511. <https://doi.org/10.1007/s00127-012-0556-z>
- [23] Chen G, Ratcliffe J. A Review of the Development and Application of Generic Multi-Attribute Utility Instruments for Paediatric Populations. *PharmacoEconomics*. 2015; 33: 1013–1028. <https://doi.org/10.1007/s40273-015-0286-7>
- [24] Greger HK, Myhre AK, Lydersen S, Jozefiak T. Child maltreatment and quality of life: a study of adolescents in residential care. *Health and Quality of Life Outcomes*. 2016; 14: 74. <https://doi.org/10.1186/s12955-016-0479-6>
- [25] Jernbro C, Tindberg Y, Lucas S, Janson S. Quality of life among Swedish school children who experienced multitype child maltreatment. *Acta Paediatrica* (Oslo, Norway : 1992). 2015; 104: 320–325. <https://doi.org/10.1111/apa.12873>
- [26] Weber S, Jud A, Landolt MA. Quality of life in maltreated children and adult survivors of child maltreatment: a systematic review. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2016; 25: 237–255. <https://doi.org/10.1007/s11136-015-1085-5>
- [27] Pierce H, Jones MS, Shoaf H, Heim M. Early Adverse Childhood Experiences and Positive Functioning during Adolescence. *Journal of Youth and Adolescence*. 2023; 52: 913–930. <https://doi.org/10.1007/s10964-022-01729-8>
- [28] Sun X. Child Maltreatment and Quality of Life Among Urban Chinese Children. *Journal of Interpersonal Violence*. 2021; 36: NP13077–NP13093. <https://doi.org/10.1177/0886260519900331>
- [29] Lo CKM, Ho FKW, Yan E, Lu Y, Chan KL, Ip P. Associations Between Child Maltreatment and Adolescents' Health-Related Quality of Life and Emotional and Social Problems in Low-Income Families, and the Moderating Role of Social Support. *Journal of Interpersonal Violence*. 2021; 36: 7436–7455. <https://doi.org/10.1177/0886260519835880>
- [30] Luo S, Feng X, Lin L, Li J, Chen W, Guo VY. Association of adverse and positive childhood experiences with health-related quality of life in adolescents. *Public Health*. 2024; 228: 92–99. <https://doi.org/10.1016/j.puhe.2024.01.006>
- [31] Chen D, Lin L, Feng X, Luo S, Xiang H, Qin K, et al. Adverse childhood experiences, problematic internet use, and health-related quality of life in Chinese adolescents. *European Journal of Psychotraumatology*. 2023; 14: 2218248. <https://doi.org/10.1080/20008066.2023.2218248>
- [32] Jia H, Lubetkin EI. Impact of adverse childhood experiences on quality-adjusted life expectancy in the U.S. population. *Child Abuse & Neglect*. 2020; 102: 104418. <https://doi.org/10.1016/j.chiabu.2020.104418>
- [33] Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, et al. The enduring effects of abuse and related adverse experiences in childhood. A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neuroscience*. 2006; 256: 174–186. <https://doi.org/10.1007/s00406-005-0624-4>
- [34] Ji W, Liu L, Tang P, Zhao L, Wen Z, Qu G, et al. Associations of adverse childhood experiences and depressive symptoms among children and adolescents: the mediating effect of resilience and sleep quality. *Scientific Reports*. 2025; 15: 42154. <https://doi.org/10.1038/s41598-025-25994-2>
- [35] Park EJ, Kim SY, Kim Y, Sung D, Kim B, Hyun Y, et al. The Relationship between Adverse Childhood Experiences and Sleep Problems among Adolescent Students: Mediation by Depression or Anxiety. *International Journal of Environmental Research and Public Health*. 2020; 18: 236. <https://doi.org/10.3390/ijerph18010236>
- [36] Fortin M, Lapointe L, Hudon C, Vanasse A, Ntetu AL, Maltais D. Multimorbidity and quality of life in primary care: a systematic review. *Health and Quality of Life Outcomes*. 2004; 2: 51. <https://doi.org/10.1186/1477-7525-2-51>
- [37] Baldwin JR, Reuben A, Newbury JB, Danese A. Agreement Between Prospective and Retrospective Measures of Childhood Maltreatment: A Systematic Review and Meta-analysis. *JAMA Psychiatry*. 2019; 76: 584–593. <https://doi.org/10.1001/jamapsychiatry.2019.0097>
- [38] Colman I, Kingsbury M, Garad Y, Zeng Y, Naicker K, Patten S, et al. Consistency in adult reporting of adverse childhood experiences. *Psychological Medicine*. 2016; 46: 543–549. <https://doi.org/10.1017/S0033291715002032>
- [39] Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*. 2004; 45: 260–273. <https://doi.org/10.1111/j.1469-7610.2004.00218.x>
- [40] Baldwin JR, Coleman O, Francis ER, Danese A. Prospective and Retrospective Measures of Child Maltreatment and Their Association With Psychopathology: A Systematic Review and Meta-Analysis. *JAMA Psychiatry*. 2024; 81: 769–781. <https://doi.org/10.1001/jamapsychiatry.2024.0818>
- [41] Harding S, Whitrow M, Maynard MJ, Teyhan A. Cohort profile: The DASH (Determinants of Adolescent Social well-being and Health) Study, an ethnically diverse cohort. *International Journal of Epidemiology*. 2007; 36: 512–517. <https://doi.org/10.1093/ije/dym094>
- [42] The National Lottery Community Fund, Anna Freud, University of Manchester. *Mental Health and Wellbeing: HeadStart Cohort, 2017–2021*. 2023. Available at: <https://www.annafreud.org/research/past-research-projects/the-headstart-learning-programme/> (Accessed: 5 September 2025).
- [43] Harding S, Read UM, Molaodi OR, Cassidy A, Maynard MJ, Lenguerrand E, et al. The Determinants of young Adult Social well-being and Health (DASH) study: diversity, psychosocial determinants and health. *Social Psychiatry and Psychiatric Epidemiology*. 2015; 50: 1173–1188. <https://doi.org/10.1007/s00127-015-1047-9>
- [44] Office for National Statistics. *How life has changed in Cornwall: Census 2021*. 2023. Available at: <https://www.ons.gov.uk/visualisations/censusareachanges/E06000052/> (Accessed: 21 September 2025).
- [45] Anna Freud. *HeadStart national evaluation final report: Appendix 1 – Evaluation approach*. London: 23 May. 2023.
- [46] YouthinMind Ltd. *Information for researchers and professionals about the Strengths & Difficulties Questionnaires*. Available at: <https://www.sdqinfo.org/> (Accessed: 18 July 2025).
- [47] Goodman R. The Strengths and Difficulties Questionnaire: a research note. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*. 1997; 38: 581–586. <https://doi.org/10.1111/j.1469-7610.1997.tb01545.x>
- [48] Stevens K. Assessing the performance of a new generic measure of health-related quality of life for children and refining it for use in health state valuation. *Applied Health Economics and Health Policy*. 2011; 9: 157–169. <https://doi.org/10.2165/11587350-000000000-00000>
- [49] Sharma R, Gu Y, Sinha K, Aghdaee M, Parkinson B. Mapping the Strengths and Difficulties Questionnaire onto the Child

- Health Utility 9D in a large study of children. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2019; 28: 2429–2441. <https://doi.org/10.1007/s11136-019-02220-x>
- [50] Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial-based cost-effectiveness analysis: the importance of controlling for baseline utility. *Health Economics*. 2005; 14: 487–496. <https://doi.org/10.1002/hec.944>
- [51] HM Government. Supporting Families Programme guidance 2022 to 2025. 2022. Available at: <https://www.gov.uk/government/publications/supporting-families-programme-guidance-2022-to-2025> (Accessed: 11 August 2025).
- [52] Department for Education. Free school meals: guidance for schools and local authorities. 2025. Available at: <https://www.gov.uk/government/publications/developing-quality-tuition-effective-practice-in-schools-free-school-meals> (Accessed: 11 September 2025).
- [53] Abdi H, Valentin D. Multiple correspondence analysis. *Encyclopedia of Measurement and Statistics*. 2007; 2: 651–657.
- [54] van Buuren S, Groothuis-Oudshoorn K. mice: Multivariate Imputation by Chained Equations in R. *Journal of Statistical Software*. 2011; 45: 1–67. <https://doi.org/10.18637/jss.v045.i03>
- [55] StataCorp. Stata Statistical Software: Release 18. StataCorp LLC.: College Station, TX. 2024.
- [56] White IR, Royston P, Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in Medicine*. 2011; 30: 377–399. <https://doi.org/10.1002/sim.4067>
- [57] Rubin DB. *Multiple Imputation for Nonresponse in Surveys*. Wiley: New York. 1987.
- [58] Robins JM, Hernán MA, Brumback B. Marginal structural models and causal inference in epidemiology. *Epidemiology (Cambridge, Mass.)*. 2000; 11: 550–560. <https://doi.org/10.1097/00001648-200009000-00011>
- [59] Austin PC, Stuart EA. Moving towards best practice when using inverse probability of treatment weighting (IPTW) using the propensity score to estimate causal treatment effects in observational studies. *Statistics in Medicine*. 2015; 34: 3661–3679. <https://doi.org/10.1002/sim.6607>
- [60] Thai TTH, Engel L, Perez JK, Tan EJ, Eades S, Sanci L, et al. A systematic review of health state utility values and psychometric performance of generic preference-based instruments for children and adolescents with mental health problems. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2023; 32: 3005–3026. <https://doi.org/10.1007/s11136-023-03441-x>
- [61] Hamby S, Taylor E, Mitchell K, Jones L, Newlin C. Health-Related Quality of Life among Adolescents as a Function of Victimization, other Adversities, and Strengths. *Journal of Pediatric Nursing*. 2020; 50: 46–53. <https://doi.org/10.1016/j.pedn.2019.11.001>
- [62] Jud A, Landolt MA, Tatalias A, Lach LM, Lips U. Health-related quality of life in the aftermath of child maltreatment: follow-up study of a hospital sample. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2013; 22: 1361–1369. <https://doi.org/10.1007/s11136-012-0262-z>
- [63] Weber S, Jud A, Landolt MA, Goldbeck L. Predictors of health-related quality of life in maltreated children and adolescents. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2017; 26: 2717–2727. <https://doi.org/10.1007/s11136-017-1615-4>
- [64] Khanna D, Khadka J, Mpundu-Kaambwa C, Lay K, Russo R, Ratcliffe J, et al. Are We Agreed? Self- Versus Proxy-Reporting of Paediatric Health-Related Quality of Life (HRQoL) Using Generic Preference-Based Measures: A Systematic Review and Meta-Analysis. *Pharmacoeconomics*. 2022; 40: 1043–1067. <https://doi.org/10.1007/s40273-022-01177-z>
- [65] Aymerich M, Cladellas R, Castelló A, Casas F, Cunill M. The Evolution of Life Satisfaction Throughout Childhood and Adolescence: Differences in Young People’s Evaluations According to Age and Gender. *Child Indicators Research*. 2021; 14: 2347–2369. <https://doi.org/10.1007/s12187-021-09846-9>
- [66] Orben A, Lucas RE, Fuhrmann D, Kievit RA. Trajectories of adolescent life satisfaction. *Royal Society Open Science*. 2022; 9: 211808. <https://doi.org/10.1098/rsos.211808>
- [67] Chen X, Cai Z, He J, Fan X. Gender Differences in Life Satisfaction Among Children and Adolescents: A Meta-analysis. *Journal of Happiness Studies*. 2020; 21: 2279–2307. <https://doi.org/10.1007/s10902-019-00169-9>
- [68] The Children’s Society. *The Good Childhood Report 2024*. London; 24 August. 2024.
- [69] Zaborskis A, Grincaite M. Gender and Age Differences in Social Inequality on Adolescent Life Satisfaction: A Comparative Analysis of Health Behaviour Data from 41 Countries. *International Journal of Environmental Research and Public Health*. 2018; 15: 1297. <https://doi.org/10.3390/ijerph15071297>
- [70] Maleki A, Faghihzadeh E, Youseflu S, Barjasteh SZ. Socio-economic inequalities in health-related quality of life among Iranian young people in the middle stage of adolescence: application of Health Equity Assessment Toolkit. *BMC Pediatrics*. 2023; 23: 16. <https://doi.org/10.1186/s12887-022-03815-z>
- [71] Michel G, Bisegger C, Fuhr DC, Abel T, KIDSCREEN group. Age and gender differences in health-related quality of life of children and adolescents in Europe: a multilevel analysis. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2009; 18: 1147–1157. <https://doi.org/10.1007/s11136-009-9538-3>
- [72] Meade T, Dowswell E. Health-related quality of life in a sample of Australian adolescents: gender and age comparison. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2015; 24: 2933–2938. <https://doi.org/10.1007/s11136-015-1033-4>
- [73] Brisson R, Mendes FG, Catunda C. Accounting for the gender gap in adolescents’ life satisfaction: evidence from nationally representative samples of school attendees in Luxembourg. *International Journal of Adolescence and Youth*. 2023; 28. <https://doi.org/10.1080/02673843.2023.2283563>
- [74] Guo J, Basarkod G, Perales F, Parker PD, Marsh HW, Donald J, et al. The Equality Paradox: Gender Equality Intensifies Male Advantages in Adolescent Subjective Well-Being. *Personality & Social Psychology Bulletin*. 2024; 50: 147–164. <https://doi.org/10.1177/01461672221125619>
- [75] Bisegger C, Cloetta B, von Rueden U, Abel T, Ravens-Sieberer U, European Kidscreen Group. Health-related quality of life: gender differences in childhood and adolescence. *Sozial- Und Präventivmedizin*. 2005; 50: 281–291. <https://doi.org/10.1007/s00038-005-4094-2>
- [76] Piko BF, Hamvai C. Parent, school and peer-related correlates of adolescents’ life satisfaction. *Children and Youth Services Review*. 2010; 32: 1479–1482. <https://doi.org/10.1016/j.childyouth.2010.07.007>
- [77] Shin H, Jeon S, Cho I. Factors influencing health-related quality of life in adolescent girls: a path analysis using a multi-mediation model. *Health and Quality of Life Outcomes*. 2022; 20: 50. <https://doi.org/10.1186/s12955-022-01954-6>
- [78] Henkens JHD, Kalmijn M, de Valk HAG. Life Satisfaction Development in the Transition to Adulthood: Differences by Gender and Immigrant Background. *Journal of Youth and Adolescence*. 2022; 51: 305–319. <https://doi.org/10.1007/s10964-021-01560-7>
- [79] Esteban-Gonzalo S, Esteban-Gonzalo L, Cabanas-Sánchez V,

- Miret M, Veiga OL. The Investigation of Gender Differences in Subjective Wellbeing in Children and Adolescents: The UP&DOWN Study. *International Journal of Environmental Research and Public Health*. 2020; 17: 2732. <https://doi.org/10.3390/ijerph17082732>
- [80] Moksnes UK, Espnes GA. Self-esteem and life satisfaction in adolescents-gender and age as potential moderators. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2013; 22: 2921–2928. <https://doi.org/10.1007/s11136-013-0427-4>
- [81] Griffiths S, Murray SB, Bentley C, Gratwick-Sarll K, Harrison C, Mond JM. Sex Differences in Quality of Life Impairment Associated With Body Dissatisfaction in Adolescents. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*. 2017; 61: 77–82. <https://doi.org/10.1016/j.jadohealth.2017.01.016>
- [82] Papageorgiou A, Fisher C, Cross D. “Why don’t I look like her?” How adolescent girls view social media and its connection to body image. *BMC Women’s Health*. 2022; 22: 261. <https://doi.org/10.1186/s12905-022-01845-4>
- [83] Johansson K, Laflamme L, Eliasson M. Adolescents’ Perceived Safety and Security in Public Space—A Swedish Focus Group Study with a Gender Perspective. *YOUNG*. 2012; 20: 69–88. <https://doi.org/10.1177/110330881102000104>
- [84] Walker S. Making Spaces for Girls. *The Journal of Public Space*. 2024; 9: 89–98. <https://doi.org/10.32891/jps.v9i1.1820>
- [85] Eagly AH, Szczesny S. Editorial: Gender Roles in the Future? Theoretical Foundations and Future Research Directions. *Frontiers in Psychology*. 2019; 10: 1965. <https://doi.org/10.3389/fpsyg.2019.01965>
- [86] Eagly AH, Wood W, Johannesen-Schmidt MC. Social role theory of sex differences and similarities. *The Wiley Blackwell Encyclopedia of Gender and Sexuality Studies*. John Wiley & Sons: Chichester. 2001.
- [87] Brisson R, Adayeva A, Abdrakhmanova S. Gender differences in adolescents’ life satisfaction: A replication study in Kazakhstan. *Journal of Adolescence*. 2025; 97: 301–309. <https://doi.org/10.1002/jad.12404>
- [88] Eriksson K, Strimling P. Gender differences in competitiveness and fear of failure help explain why girls have lower life satisfaction than boys in gender equal countries. *Frontiers in Psychology*. 2023; 14: 1131837. <https://doi.org/10.3389/fpsyg.2023.1131837>
- [89] Marquez J. Gender Differences in School Effects on Adolescent Life Satisfaction: Exploring Cross-National Variation. *Child Youth Care Forum*. 2024; 53: 389–409. <https://doi.org/10.1007/s10566-023-09756-7>
- [90] Filmer D, Pritchett LH. Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of India. *Demography*. 2001; 38: 115–132. <https://doi.org/10.1353/dem.2001.0003>
- [91] Vyas S, Kumaranayake L. Constructing socio-economic status indices: how to use principal components analysis. *Health Policy and Planning*. 2006; 21: 459–468. <https://doi.org/10.1093/heapol/czl029>
- [92] Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health*. 2006; 60: 7–12. <https://doi.org/10.1136/jech.2004.023531>
- [93] Krieger N, Williams DR, Moss NE. Measuring social class in US public health research: concepts, methodologies, and guidelines. *Annual Review of Public Health*. 1997; 18: 341–378. <https://doi.org/10.1146/annurev.publhealth.18.1.341>
- [94] Zaneva M, Dumbalska T, Reeves A, Bowes L. What do we mean when we talk about socioeconomic status? Implications for measurement, mechanisms and interventions from a critical review on adolescent mental health. *General Psychiatry*. 2024; 37: e101455. <https://doi.org/10.1136/gpsych-2023-101455>
- [95] Kororus KM, Bradley RH, Luthar SS, Li L, Levy R, Cahill KM, et al. Socioeconomic status and depressive symptoms: An individual-participant data meta-analysis on range restriction and measurement in the United States. *Journal of Affective Disorders*. 2022; 314: 50–58. <https://doi.org/10.1016/j.jad.2022.06.090>
- [96] von Rueden U, Gosch A, Rajmil L, Bisegger C, Ravens-Sieberer U. Socioeconomic determinants of health related quality of life in childhood and adolescence: results from a European study. *Journal of Epidemiology and Community Health*. 2006; 60: 130–135. <https://doi.org/10.1136/jech.2005.039792>
- [97] Gautam N, Dessie G, Rahman MM, Khanam R. Socioeconomic status and health behavior in children and adolescents: a systematic literature review. *Frontiers in Public Health*. 2023; 11: 1228632. <https://doi.org/10.3389/fpubh.2023.1228632>
- [98] Qin Z, Wang N, Ware RS, Sha Y, Xu F. Lifestyle-related behaviors and health-related quality of life among children and adolescents in China. *Health and Quality of Life Outcomes*. 2021; 19: 8. <https://doi.org/10.1186/s12955-020-01657-w>
- [99] McLaughlin KA, Costello EJ, Leblanc W, Sampson NA, Kessler RC. Socioeconomic status and adolescent mental disorders. *American Journal of Public Health*. 2012; 102: 1742–1750. <https://doi.org/10.2105/AJPH.2011.300477>
- [100] Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. *Social Science & Medicine* (1982). 2013; 90: 24–31. <https://doi.org/10.1016/j.socscimed.2013.04.026>
- [101] Wallander JL, Fradkin C, Elliott MN, Cuccaro PM, Tortolero Emery S, Schuster MA. Racial/ethnic disparities in health-related quality of life and health status across pre-, early-, and mid-adolescence: a prospective cohort study. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2019; 28: 1761–1771. <https://doi.org/10.1007/s11136-019-02157-1>
- [102] Virdis JM, Anselmi L, Sutton M. Differences in rating of health related quality of life on the EQ-5D-5 L between ethnic groups. *Quality of Life Research : an International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. 2025; 34: 3231–3243. <https://doi.org/10.1007/s11136-025-04082-y>
- [103] Ahmad G, McManus S, Bécares L, Hatch SL, Das-Munshi J. Explaining ethnic variations in adolescent mental health: a secondary analysis of the Millennium Cohort Study. *Social Psychiatry and Psychiatric Epidemiology*. 2022; 57: 817–828. <https://doi.org/10.1007/s00127-021-02167-w>
- [104] Blakey R, Morgan C, Gayer-Anderson C, Davis S, Beards S, Harding S, et al. Prevalence of conduct problems and social risk factors in ethnically diverse inner-city schools. *BMC Public Health*. 2021; 21: 849. <https://doi.org/10.1186/s12889-021-10834-5>
- [105] Watkinson RE, Sutton M, Turner AJ. Ethnic inequalities in health-related quality of life among older adults in England: secondary analysis of a national cross-sectional survey. *The Lancet. Public Health*. 2021; 6: e145–e154. [https://doi.org/10.1016/S2468-2667\(20\)30287-5](https://doi.org/10.1016/S2468-2667(20)30287-5)
- [106] Kim I, Kim N, Jang H. Adverse Childhood Experiences and Intersectionality of Sex, Race, and Poverty in Adolescents: A Descriptive Analysis. *Journal of Asia Pacific Counseling*. 2023; 13: 79–90. <https://doi.org/10.18401/2023.13.1.6>
- [107] Giano Z, Schwab-Reese L, Mishra AA, Hubach RD, Johnson RL, Epperson CN, et al. Intersectionality and Adverse Childhood Experiences: Comparing Subgroups of Sex, Race/Ethnicity, and Sexual Orientation. *American Journal of Preventive Medicine*. 2023; 65: 30–38. <https://doi.org/10.1016/j.amepre.2023.01.025>

- [108] Abrahamyan A, Severo M, Soares S, Fraga S, Amorim M. The Interaction Effect of Adverse Childhood Experiences and Socioeconomic Circumstances in Adolescent Depressive Symptomatology. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*. 2024; 75: 591–599. <https://doi.org/10.1016/j.jadohealth.2024.05.029>
- [109] Chandrasekar R, Karamanos A, Learoyd A, Khanolkar AR. Sexual identity-related inequalities in associations between adverse childhood experiences and health in late adolescence-A national cohort study. *PloS One*. 2024; 19: e0312161. <https://doi.org/10.1371/journal.pone.0312161>
- [110] Gajos JM, Miller CR, Leban L, Cropsey KL. Adverse childhood experiences and adolescent mental health: Understanding the roles of gender and teenage risk and protective factors. *Journal of Affective Disorders*. 2022; 314: 303–308. <https://doi.org/10.1016/j.jad.2022.07.047>
- [111] Amele S, McCabe R, Kibuchi E, Pearce A, Hainey K, Demou E, et al. Quality of ethnicity data within Scottish health records and implications of misclassification for ethnic inequalities in severe COVID-19: a national linked data study. *Journal of Public Health*. 2024; 46: 116–122. <https://doi.org/10.1093/pubmed/fdad196>
- [112] Ross PT, Hart-Johnson T, Santen SA, Zaidi NLB. Considerations for using race and ethnicity as quantitative variables in medical education research. *Perspectives on Medical Education*. 2020; 9: 318–323. <https://doi.org/10.1007/s40037-020-00602-3>
- [113] Lam J, Koay AC, Cortina-Borja M, Aldridge R, Blackburn R, Harron K. Intersectional relationships between age, sex, ethnicity, nationality and experience of racism in the UK using different ethnicity categorisations: A comparative study using survey data. *Journal of Migration and Health*. 2026; 13: 100384. <https://doi.org/10.1016/j.jmh.2025.100384>