ORIGINAL RESEARCH

Abuse in Childhood and Cardiometabolic Health in Early Adulthood: Evidence From the Avon Longitudinal Study of Parents and Children

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BACKGROUND: Although childhood abuse has been consistently associated with cardiovascular disease in later adulthood, its associations with cardiometabolic health in younger adults are poorly understood. We assessed associations between childhood physical, sexual, and psychological abuse and cardiometabolic outcomes at 18 and 25 years.

METHODS AND RESULTS: We used data on 3223 participants of the ALSPAC (Avon Longitudinal Study of Parents and Children). Exposure to childhood abuse was self-reported retrospectively at 22 years. We used linear regression to assess the associations between childhood abuse and cardiometabolic outcomes at 18 and 25 years. At 18 years, physical (β 1.35 kg/m^2; 95% CI, 0.66–2.05), sexual (β 0.57 kg/m^2; 95% CI 0.04–1.11), and psychological (β 0.47 kg/m^2; 95% CI 0.01–0.92) abuse were associated with higher body mass index. Physical abuse was also associated with lower high-density lipoprotein cholesterol (β −0.07 mmol/L; 95% CI, −0.13 to −0.01) and higher C-reactive protein (31%; 95% CI, 1%–69%), and sexual abuse was associated with higher heart rate (β 1.92 bpm; 95% CI 0.26–3.58). At age 25, all 3 types of abuse were additionally associated with higher insulin, and sexual abuse was associated with lower cholesterol (−0.14 mmol/L; 95% CI, −0.26 to −0.01). The age at which abuse occurred (<11or 11–17 years) had little influence on the associations, and when sex differences were evident, associations were stronger in men.

CONCLUSIONS: Childhood abuse is associated with negative cardiometabolic outcomes even by young adulthood. Further follow-up will determine whether associations strengthen across the life course and whether sex differences persist, which is essential for targeting effective screening programs and early interventions in those who suffered abuse in childhood.

Key Words: ALSPAC ■ cardiometabolic health ■ childhood abuse

A growing body of evidence demonstrates associations of childhood abuse with a wide range of adverse mental and physical health outcomes,[1,2] including poorer cardiometabolic health. A recent review found that childhood abuse was associated with cardiovascular disease (CVD), diabetes, and higher blood pressure/hypertension in the majority of studies.[3] However, the age at which associations between childhood abuse and poor cardiometabolic health emerge is unclear. Most studies explore the association of childhood abuse with cardiometabolic health later in adulthood. Those who have investigated cardiometabolic outcomes in younger age groups have found inconsistent results.[4–9] A systematic review reported a strong association between childhood maltreatment and obesity in adults, but this was not

CLINICAL PERSPECTIVE

What Is New?

- Physical, sexual, and psychological abuse were associated with higher body mass index at 18 years; at age 25 these types of abuse were also associated with higher insulin. Additional associations were observed for specific types of abuse with outcomes at both ages 18 and 25 years.
- Similar associations were observed if abuse occurred in childhood (<11 years) or adolescence (11–17 years).
- Most associations did not differ by sex, but men had stronger associations between sexual abuse and higher heart rate at both 18 and 25 years and between psychological abuse and higher triglycerides and higher C-reactive protein at 25 years.

What Are the Clinical Implications?

- Downstream effects of childhood abuse on cardiometabolic risk factors were observed in early adulthood.
- People who experience abuse in childhood may benefit from early screening for cardiometabolic health.

apparent in children and adolescents.[10] Longitudinal studies assessing body mass index (BMI) trajectories show that associations with childhood abuse vary by age and type of abuse, and positive associations emerge later in adulthood.[9] Understanding the age at which associations arise are essential for prevention efforts.

Women experience a greater burden of sexual abuse, whereas physical abuse is more common in men.[2] Sex differences in cardiometabolic health also exist, which might be driven by sex hormones, sex-specific molecular mechanisms, including glucose and lipid metabolism, as well as cardiac energy metabolism and cardiac function.[11] Sex differences in the associations between childhood abuse and cardiometabolic health are therefore plausible but evidence is limited, and among the studies that have explored sex differences, no consistent pattern has been found.[2,3]

Many studies examine a broad range of adversities under the adverse childhood experiences umbrella,[2,12] which can include highly heterogeneous exposures (eg, childhood abuse, neglect, and several forms of household dysfunction), often combined into a summary score.[13] But there is limited understanding of how childhood abuse specifically affects cardiometabolic health. Furthermore, most studies fail to consider the frequency and/or timing of the abuse.

We aimed to assess the associations of physical, sexual, and psychological abuse in childhood with measures of cardiometabolic health in early adulthood (18 and 25 years) in a contemporary general population cohort, explore whether there are sex differences in these associations and whether associations differ by the age at which childhood abuse occurred.

METHODS

Data Availability

Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers may be sent to the ALSPAC (Avon Longitudinal Study of Parents and Children) Executive Committee at https://proposals.epi.bristol.ac.uk/.

Study Population

The ALSPAC is a prospective population-based pregnancy cohort (see www.alspac.bris.ac.uk) that recruited pregnant women living in the Avon area of the United Kingdom who were due to give birth between April 1991 and December 1992.[14] In total, 14 541 pregnancies were enrolled and children, mothers, and their partners have been followed up repeatedly ever since. Please note that the study website contains details of all the data that are available through a fully searchable data dictionary and variable search tool. For full details of the data from the ALSPAC study, see http://www.bristol.ac.uk/alspac/researchers/our-data.

The study participant flow is given in Figure 1. Participants were included if they had data on at least one type of abuse and one cardiometabolic outcome. Participants pregnant at the 18- and 25-year clinic assessments were excluded as pregnancy could alter BMI and cardiometabolic health outcomes, resulting in the inclusion of 3223 participants in the study. Ethical approval was obtained from the ALSPAC Law and Ethics Committee and the Local Research Ethics Committee. Consent for biological samples has been collected in accordance with the Human Tissue Act (2004).

Abuse in Childhood

Exposure to childhood abuse (before 18 years) was retrospectively self-reported in a questionnaire at 22 years. The questionnaire used to collect information on abuse was based on the Child Abuse Questionnaire[15] and the Sexual Experiences Survey[16] and includes the 3 main types of abuse: physical, sexual, and psychological abuse; see http://www.bristol.ac.uk/media-library/sites/alspac/documents/questionnaires/YPB-life-at-22-plus.pdf, section H. Participants were asked about experiences occurring
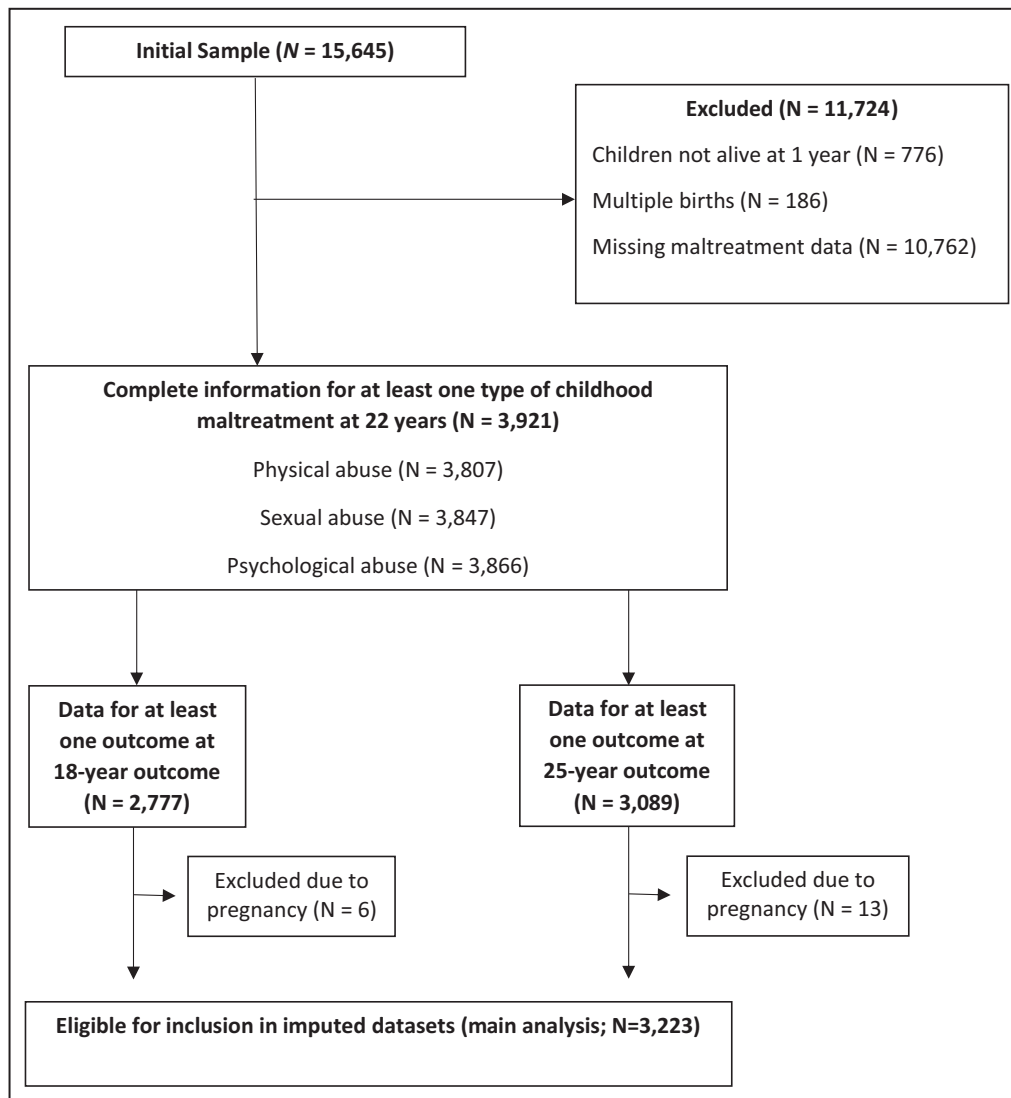
Figure 1.   Study flow.

in childhood (before 11 years), and during adolescence (11–17 years). Details about the abuse categorization are available in Data S1. We assessed abuse in each time period (<11/11–17 years) and also combined both time periods to indicate abuse <18 years and generated a summary score varying from 0 (no experience of abuse <18 years old) to 3 (experience of all abuse types <18 years old).

The study data were collected and managed using REDCap electronic data capture tools hosted at University of Bristol.[17]

Outcomes

Height and weight were measured in research clinics at both 18 and 25 years using standard procedures. Participants fasted overnight or for a minimum of 6 hours. Total cholesterol, plasma triglycerides, and high-density lipoprotein (HDL) cholesterol were measured using enzymatic reagents for lipid determination from the standard Lipid Research Clinics Protocol. Low-density lipoprotein cholesterol concentrations were calculated using the Friedewald equation.[18] Serum insulin was measured with ELISA (Mercodia, Uppsala, Sweden), which does not cross-react with proinsulin. An automated particle-enhanced immunoturbidimetric assay (Roche UK, Welwyn Garden City, United Kingdom) was used to measure plasma glucose and CRP (C-reactive protein).

Confounders

We considered household occupational social class, maternal and paternal education, ethnicity, age, and sex as potential confounders. Household occupational social class was assessed at recruitment to the

study and defined based on the highest of mothers' and their partners' self-reported occupation using the 1991 British Office of Population and Census Statistics classification. Maternal and paternal education were also assessed at recruitment and correspond to the highest educational attainment achieved. Race/ethnicity was classified as White/non-White, as most participants were of White race (96%).

Statistical Analysis

Data were analyzed using Stata 16.1 (Stata Corp., College Station, TX, 2016). Positively skewed outcome variables were log-transformed for analyses and back transformed for presentation of results.

We investigated each type of abuse separately and assessed associations of childhood abuse with cardiometabolic health considering abuse exposure occurring (1) before 11 years, (2) between 11 and 17 years, and (3) at any age before 18 years. We used linear regression to estimate associations of childhood abuse with measures of cardiometabolic health at 18 and 25 years, unadjusted and adjusted for the potential confounders defined previously. We used the outcomes in their original units, as well as standardized measures to allow comparability across the different outcomes. We compared the associations for abuse <11 years and between 11 and 17 years by comparing the point estimates and examining whether 95% CI overlapped and by using seemingly unrelated estimation to assess the difference between the coefficients. We explored possible sex differences in the associations between childhood abuse and cardiometabolic outcomes in a model including an interaction term between each type of childhood abuse and sex.

We also used linear regression to examine the association between a summary score of abuse types that occurred <18 years (ranging from 0 to 3) and the cardiometabolic outcomes. We assessed whether there was a dose-response relationship (ie, increase in the outcomes by increase in the score of abuse) by using the score as continuous and a Wald test for linear trend.

Sensitivity Analysis

Considering that different types of childhood abuse commonly co-occur, we performed sensitivity analysis with the types of abuse mutually adjusted to estimate their independent associations.

Mental health can influence the report of childhood abuse, such that individuals with higher psychological distress are more likely to report adverse childhood experiences.[19] Therefore, we also performed sensitivity analysis adjusting for depression at the time of childhood abuse reporting. Depression was measured using the Short Mood and Feelings Questionnaire,[20]

a 13-item questionnaire with score ranging between 0 and 26, in which a greater score represents higher depression.

To explore the frequency of childhood abuse occurrence, we recategorized the occurrence of each type of abuse into the following frequency categories: never, rarely/sometimes, and often/very often. As each abuse type was assessed by multiple questions, we applied the response indicating the highest frequency per type. More details are presented in Data S1.

Missing Data

There were missing data on outcomes and covariates. The highest proportion of missing data was observed for insulin at age 18 (44.7%), followed by total cholesterol, HDL, low-density lipoprotein, triglycerides, glucose, and CRP (43.7%) at 18 years (Table S1). To increase precision and reduce selection bias, we conducted multivariate multiple imputation using chained equations to impute missing information. Twenty cycles of regression switching were used and estimates of results were averaged across the imputed data sets according to Rubin's rules.[21] More details on the imputation models are available in Data S1.

We also performed analysis in those with complete data on child abuse, covariates, and outcomes (complete cases) as a sensitivity analysis.

RESULTS

Table 1 presents characteristics of the participants included in the analysis (n=3223) compared with those excluded from the analysis. Included participants were more likely to be women, White, and to have a higher socioeconomic position. Cardiometabolic health measures were generally more favorable in included participants (lower BMI, systolic blood pressure, lipids, except for HDL, and glucose), though differences were relatively small in magnitude. The distribution of data after imputation is similar to the observed data (Table S1).

Approximately 5% reported physical abuse, and it was more likely to have occurred at <11 years of age (Table 2). The report of sexual abuse was higher in female participants (12%) than in male participants (3%), and although in male participants the prevalence was similar in both age periods, in female participants it was higher between 11 and 17 years of age. Psychological abuse was also more reported by female participants (14%) than male participants (10%), and it was more likely to have occurred between 11 and 17 years of age. The co-occurrence between the different types of abuse is presented in Figure S1. Nearly 20% experienced at least 1 type of abuse, and physical and psychological abuse commonly co-occurred, such that 65% of those

Table 1. Characteristics of Participants Included in the Analysis (N=3223) and Excluded From the Analysis Owing to Missing Childhood Abuse Data (N=11 460)

Characteristics	Participants included in analysis, N (%) or mean (SD)	Participants excluded from analysis, N (%) or mean (SD)	P value
Sex			<0.001
Female	2143 (66.5)	5051 (44.1)	
Male	1080 (33.5)	6409 (55.9)	
Race, n (%)			<0.001
White	2818 (96.4)	8492 (94.5)	
Non-White	105 (3.6)	495 (5.5)	
Maternal education, n (%)			<0.001
CSE	285 (8.7)	2212 (23.8)	
Vocational	209 (7.1)	1001 (10.8)	
O level	1000 (33.9)	3235 (34.8)	
A level	849 (28.7)	1903 (20.5)	
University degree	638 (21.6)	938 (10.1)	
Paternal education, n (%)			<0.001
CSE	436 (15.0)	2636 (29.7)	
Vocational	181 (6.3)	815 (9.2)	
O level	610 (21.0)	1890 (21.3)	
A level	853 (29.4)	2209 (24.9)	
University degree	820 (28.3)	1317 (14.9)	
Social class, n (%)			<0.001
I	144 (5.2)	206 (2.5)	
II	804 (29.3)	1644 (20.4)	
III (nonmanual)	770 (28.0)	1857 (23.0)	
III (manual)	658 (24.0)	2549 (31.6)	
IV	308 (11.2)	1368 (16.9)	
V	62 (2.3)	451 (5.6)	
18-y outcomes			
BMI, kg/m^2	22.6 (4.1)	23.2 (4.4)	<0.001
Heart rate, bpm	70.1 (10.6)	69.3 (11.2)	0.030
SBP, mm Hg	115.7 (11.5)	117.9 (11.5)	<0.001
DBP, mm Hg	64.7 (7.6)	64.5 (7.4)	0.414
Total cholesterol, mmol/L	3.8 (0.7)	3.7 (0.7)	0.032
HDL, mmol/L	1.3 (0.3)	1.2 (0.3)	<0.001
LDL, mmol/L	2.1 (0.6)	2.1 (0.6)	0.559
Triglycerides, mg/dL*	0.8 (0.4)	0.9 (0.4)	0.034
Glucose, mmol/L*	5.0 (0.6)	5.1 (0.6)	0.233
Insulin, mg/dL*	8.1 (7.8)	8.7 (8.6)	0.028
CRP, mg/L*	1.5 (4.0)	1.7 (6.0)	0.268
25-y outcomes			
BMI, kg/m^2	24.7 (5.0)	25.3 (5.2)	0.001
Heart rate, bpm	70.1 (10.6)	69.3 (11.2)	0.030
SBP, mm Hg	115.5 (11.2)	117 (11.7)	<0.001
DBP, mm Hg	67.1 (7.9)	66.7 (8.0)	0.127
Total cholesterol, mmol/L	4.4 (0.8)	4.5 (0.9)	0.001
HDL, mmol/L	1.6 (0.4)	1.5 (0.4)	0.020
LDL, mmol/L	2.4 (0.7)	2.5 (0.8)	<0.001
Triglycerides, mg/dL*	0.9 (0.5)	1.0 (0.7)	<0.001

(Continued)

Table 1.   Continued

Characteristics	Participants included in analysis, N (%) or mean (SD)	Participants excluded from analysis, N (%) or mean (SD)	P value
Glucose, mmol/L*	5.3 (0.6)	5.4 (0.8)	<0.001
Insulin, mg/dL*	9.6 (9.2)	10.0 (10.0)	0.258
CRP, mg/L*	2.2 (5.3)	2.4 (8.6)	0.443

Social occupation: I: professional occupation; II: managerial and technical occupations, III: skilled occupation, IV: partly skilled occupation, V: unskilled occupations. BMI indicates body mass index; cholesterol, total cholesterol; CRP, C-reactive protein; CSE, Certificate of Secondary Education; DBP, diastolic blood pressure; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; and SBP, systolic blood pressure.

*Median (interquartile range); P values are for comparison of log-transformed values.

who reported physical abuse also reported psychological abuse (2.4% of the participants). Frequencies of abuse occurrence are reported in Table S2.

The majority of the associations between childhood abuse and cardiometabolic outcomes at 18 and 25 years was similar regardless of whether abuse occurred <11 years or between 11 and 17 years (Tables S3 and S4). The exceptions were for the associations of physical abuse with heart rate at both 18 and 25 years, glucose at 18 years, and BMI at 25 years, where stronger associations were observed for physical abuse that occurred between 11 and 17 years, and between psychological abuse and both glucose and insulin at 25 years, where stronger associations were observed for psychological abuse that occurred <11 years (Tables S3 and S4). Therefore, given the similarity of the results according to the age at which abuse occurred, the main results are reported for abuse experienced at any age <18 years.

Most associations were similar in male and female participants, and main results are therefore presented for both sexes combined. Sex-stratified results are presented in Data S1.

Cardiometabolic Health at 18 Years

Unadjusted and adjusted associations of childhood abuse with the cardiometabolic outcomes in their original scale are presented in Tables S5 and S6,

Table 2.   Prevalence of Childhood Abuse According to Age at Occurance and Sex (N=3223)

	<11 y % (95% CI)	11–17 y % (95% CI)	<18 y % (95% CI)
Male participants (n=1080)			
Physical abuse	4.8 (3.4–6.1)	0.5 (0.0–1.0)	5.0 (3.6–6.3)
Sexual abuse	2.0 (1.1–3.0)	1.9 (1.0–2.8)	3.4 (2.3–4.6)
Psychological abuse	0.8 (0.2–1.4)	10.2 (8.3–12)	10.2 (8.4–12.1)
Female participants (n=2143)			
Physical abuse	5.1 (4.1–6.0)	0.7 (0.3–1.0)	5.1 (4.1–6.1)
Sexual abuse	5.1 (4.1–6.0)	8.9 (7.7–10.2)	12.0 (10.6–13.4)
Psychological abuse	1.0 (0.6–1.4)	13.6 (12.1–15.1)	13.7 (12.2–15.2)

respectively, and adjusted associations with standardized outcomes are presented in Figures 2 through 4. Physical (β 1.35 kg/m^2; 95% CI, 0.66–2.05), sexual (β 0.57 kg/m^2; 95% CI, 0.04–1.11) and psychological (β 0.47 kg/m^2; 95% CI, 0.01–0.92) abuse were associated with higher BMI at 18 years, even when adjusting for potential confounders. Physical abuse was also associated with lower HDL (β −0.07 mmol/L, 95% CI, −0.13 to −0.01) and higher CRP (β 31%; 95% CI, 1%–69%), and sexual abuse was also associated with higher heart rate (β 0.57 bpm; 95% CI, 0.04–1.11). The only evidence for sex differences was observed for the associations between sexual abuse and both BMI and heart rate (P value for sex interaction=0.052 and 0.048, respectively), which was observed in men (BMI, β 2.15 kg/m^2; 95% CI, 0.62–3.68; heart rate, β 8.07 bpm; 95% CI, 2.02–14.12) but not women (BMI, 0.33 kg/m^2; 95% CI, −0.26 to 0.93; heart rate, β 1.25 bpm; 95% CI, −0.43 to 2.93) (Table S7).

When the types of abuse were mutually adjusted, the point estimates usually reduced, and there was evidence of an independent association of physical abuse with BMI (β 1.22 kg/m^2; 95% CI, 0.47–1.97) and HDL (β −0.07 mmol/L; 95% CI, −0.14 to −0.01) and of sexual abuse with heart rate (β 1.83 bpm; 95% CI, 0.15–3.52) (Table S8). When depression was included in the adjustment (Tables S9 through S11), the point estimates were usually attenuated compared with the main analysis, and the associations of physical abuse with higher BMI (β 1.20 kg/m^2; 95% CI, 0.50–1.90) and lower HDL (β −0.06 mmol/L; 95% CI, −0.12 to 0.00), and between sexual abuse and higher heart rate (β 1.79 bpm; 95% CI, 0.11–3.47) were still evident (Table S9). When considering the frequency of abuse occurrence, there was evidence of associations of physical abuse and sexual abuse experienced often/very often with higher BMI (Table S12). Point estimates for abuse occurring rarely/sometimes (compared with never) were generally smaller and all CIs crossed the null value. The one exception was the association of physical abuse with lower triglycerides in those reporting abuse occurring rarely/sometimes compared with never.

A higher score of childhood abuse was associated with higher BMI and higher heart rate (Table 3). Each additional experience of abuse was associated with,

Figure 2. Adjusted associations of physical abuse with cardiometabolic health outcomes at 18 and 25 years (N=3223).
Point estimates are mean differences of standardized outcome values in individuals who reported physical abuse compared with those who did not. BMI indicates body mass index; cholesterol, total cholesterol; CRP, C-reactive protein; DBP, diastolic blood pressure; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; and SBP, systolic blood pressure.

on average, 0.50 kg/m^2 (95% CI, 0.23–0.76) higher BMI, and those who experienced all types of childhood abuse had a 2.29 kg/m^2 (95% CI, 0.70–3.88) higher BMI than those who did not experience any type of abuse in childhood. Those who experienced all types of child

abuse also had a 5.43 bpm (95% CI, 0.41–10.46) higher heart rate than those who did not experience any type of abuse. No sex differences were observed for the associations between the score of childhood abuse and cardiometabolic outcomes at age 18 (Table S13).
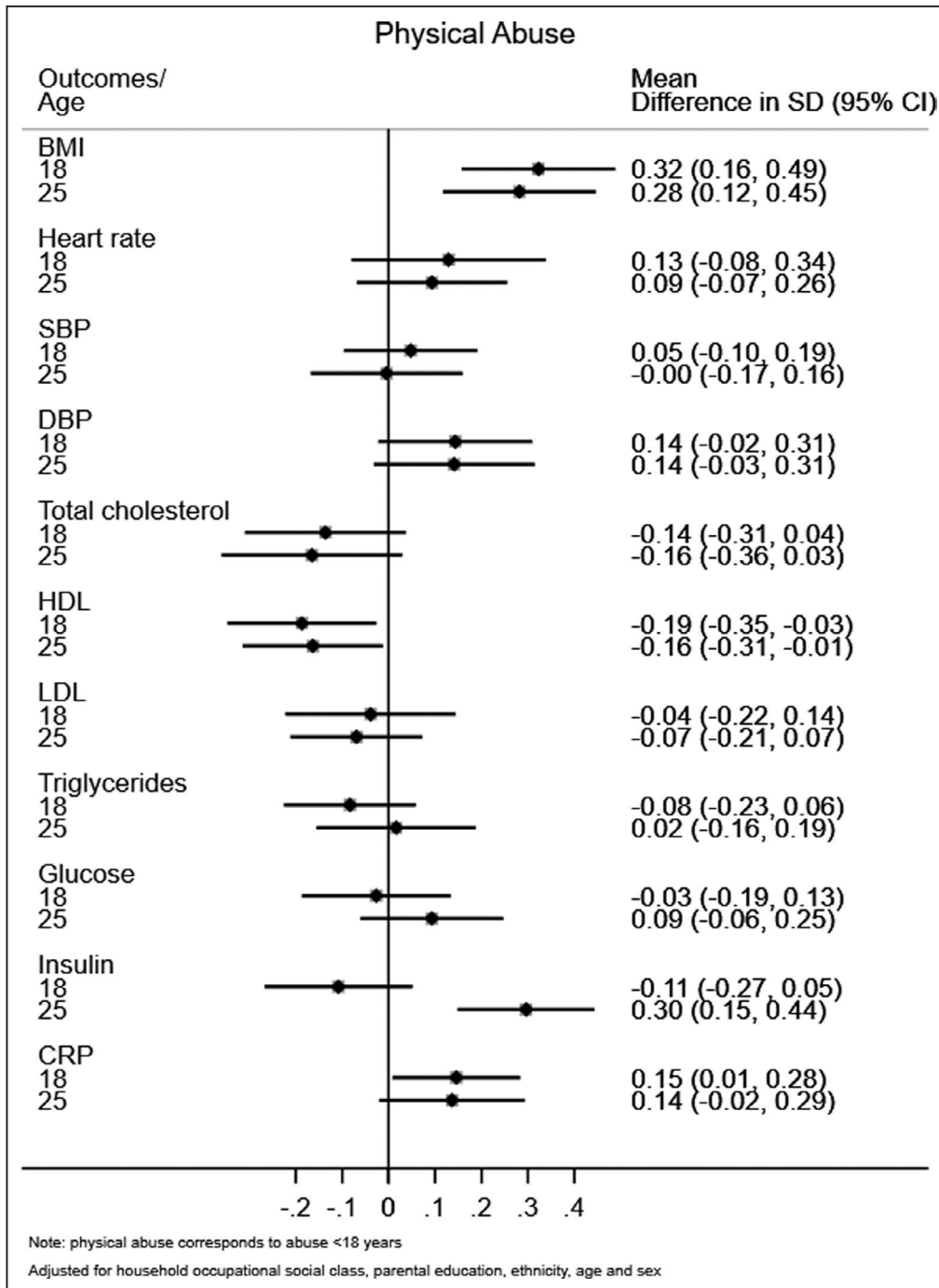
Figure 3.   Adjusted associations of sexual abuse with cardiometabolic health outcomes at 18 and 25 years (N=3223).
Point estimates are mean differences of standardized outcome values in individuals who reported sexual abuse compared with those who did not. BMI indicates body mass index; cholesterol, total cholesterol; CRP, C-reactive protein; DBP, diastolic blood pressure; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; and SBP, systolic blood pressure.

Cardiometabolic Health at 25 Years

All associations observed at 18 years were also observed at age 25, except for the association between physical abuse and CRP. Additionally, some further associations emerged at age 25. All types of abuse were also associated with higher insulin; physical abuse was associated with 0.3 SD (95% CI, 0.1–0.4) higher insulin, which corresponds to 26% (95% CI, 12–41) higher than those who did not experience physical abuse, sexual abuse was associated with 13% (95% CI, 3–23) higher
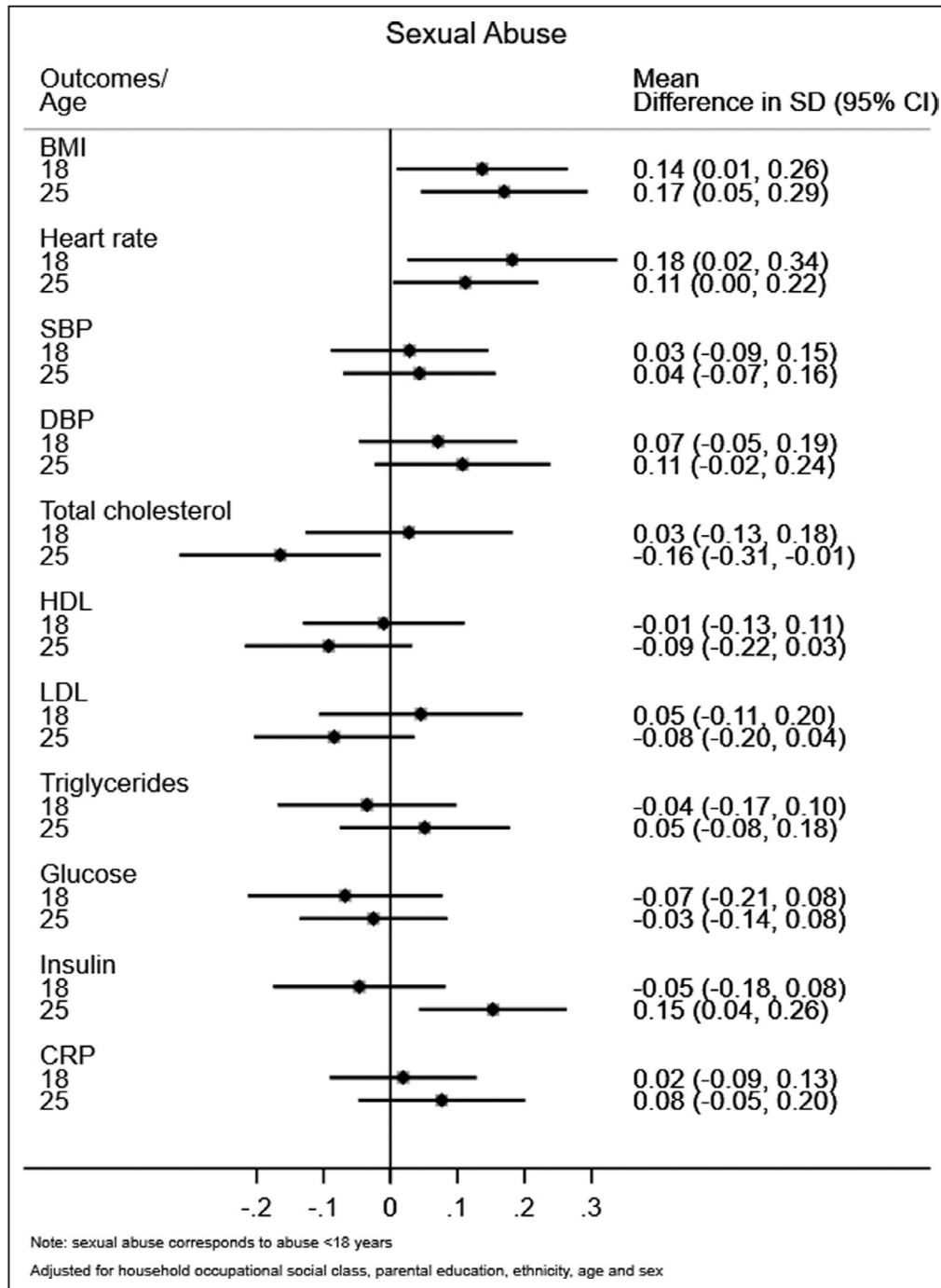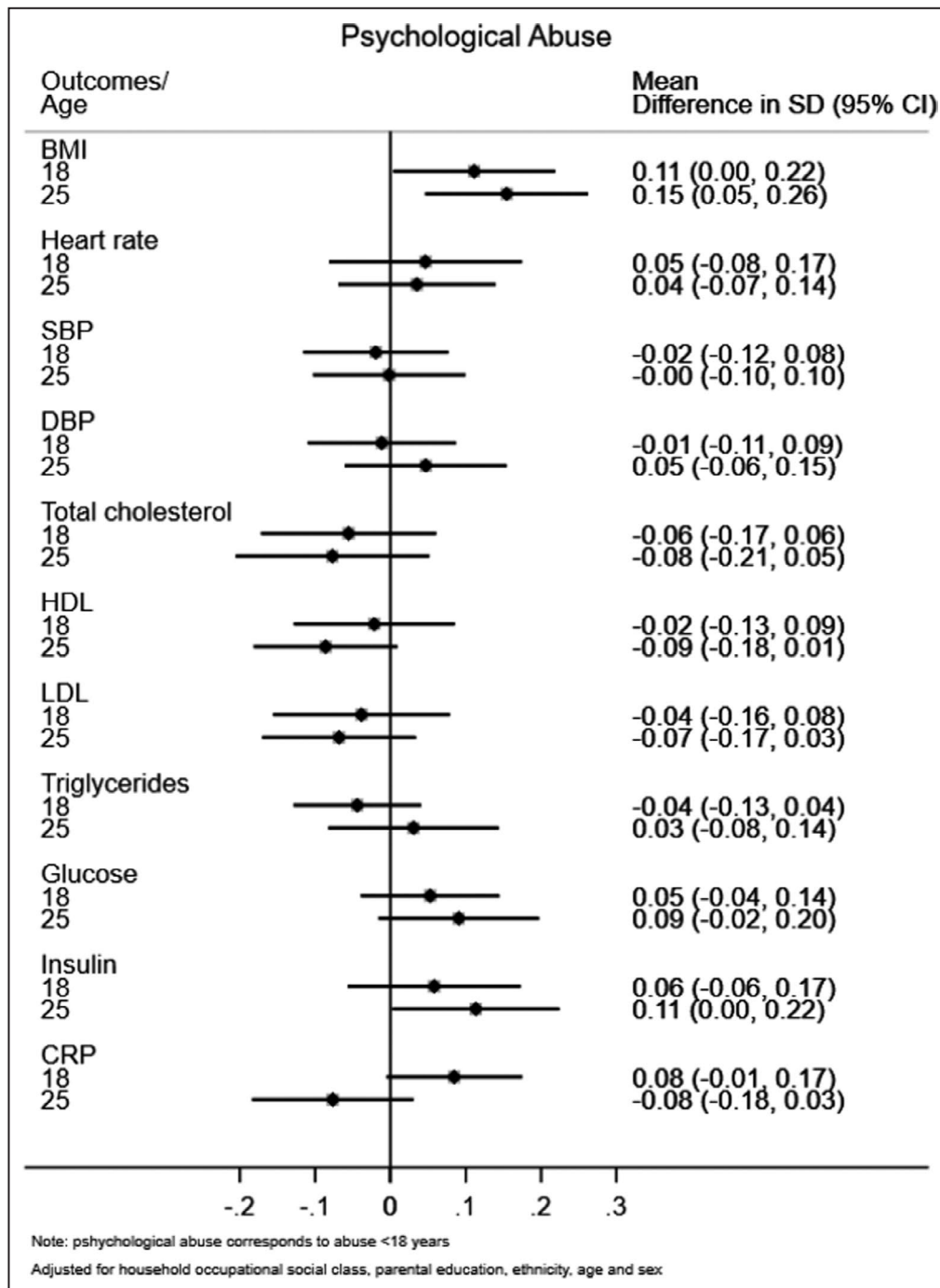
Figure 4. Adjusted associations of psychological abuse score with cardiometabolic health outcomes at 18 and 25 years (N=3223).
Point estimates are mean differences of standardized outcome values in individuals who reported psychological abuse compared with those who did not. BMI indicates body mass index; cholesterol, total cholesterol; CRP, C-reactive protein; DBP, diastolic blood pressure; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; and SBP, systolic blood pressure.

insulin, and psychological abuse was associated with 9% (95% CI, 0–19) higher insulin (Figures 2 through 4; Table S6). Sexual abuse was also associated with lower total cholesterol (β −0.14 mmol/L; 95% CI, −0.26 to −0.01).

The association between sexual abuse and higher heart rate was stronger in men (β 6.45 bpm; 95% CI, 2.66–10.24) than in women (β 1.48 bpm; 95% CI, 0.10–2.86, P value for sex interaction=0.023), and associations of psychological abuse with both

Table 3. Adjusted Association Between Score of Child Abuse and Cardiometabolic Outcomes at 18 and 25 Years (N=3223)

	Score of childhood abuse				
	1 type of abuse	2 types of abuse	3 types of abuse	Continuous	
	β (95% CI)	β (95% CI)	β (95% CI)	β (95% CI)	P value*
18-y outcomes					
BMI, kg/m²	0.34 (−0.07 to 0.75)	1.44 (0.46 to 2.42)	2.29 (0.70 to 3.88)	0.50 (0.23 to 0.76)	<0.001
Heart rate, bpm	0.43 (−0.84 to 1.69)	1.19 (−1.16 to 3.54)	5.43 (0.41 to 10.46)	0.84 (0.04, 1.64)	0.041
SBP, mm Hg	0.20 (−1.03 to 1.43)	0.07 (−1.88 to 2.02)	0.64 (−3.71 to 4.99)	0.10 (−0.73 to 0.94)	0.804
DBP, mm Hg	0.26 (−0.62 to 1.13)	1.25 (−0.24 to 2.74)	1.41 (−1.77 to 4.58)	0.34 (−0.24 to 0.93)	0.246
Cholesterol, mmol/L	−0.01 (−0.10 to 0.09)	−0.10 (−0.28 to 0.07)	−0.10 (−0.39 to 0.19)	−0.02 (−0.08 to 0.03)	0.403
HDL, mmol/L	−0.01 (−0.05 to 0.02)	−0.10 (−0.19 to 0.0)	−0.06 (−0.19 to 0.07)	−0.01 (−0.04 to 0.01)	0.234
LDL, mmol/L	0.02 (−0.06 to 0.09)	−0.07 (−0.22 to 0.08)	−0.01 (−0.28 to 0.26)	0.00 (−0.06 to 0.05)	0.845
Triglycerides, mmol/L†	0.98 (0.93 to 1.03)	1.04 (0.95 to 1.15)	0.93 (0.79 to 1.09)	0.98 (0.96 to 1.01)	0.202
Glucose, mmol/L†	1.00 (0.99 to 1.01)	1.01 (0.99 to 1.03)	1.00 (0.96 to 1.04)	1.00 (0.99 to 1.01)	0.928
Insulin, mg/dL†	0.99 (0.93 to 1.06)	1.22 (1.07 to 1.40)	0.97 (0.77 to 1.22)	0.99 (0.95 to 1.04)	0.815
CRP, mg/L†	1.06 (0.93 to 1.22)	1.04 (0.80 to 1.34)	1.48 (0.79 to 2.79)	1.11 (1.00 to 1.22)	0.051
25-y outcomes					
BMI, kg/m²	0.56 (0.06 to 1.06)	1.44 (0.46 to 2.42)	2.75 (0.80 to 4.71)	0.71 (0.39 to 1.03)	<0.001
Heart rate, bpm	0.50 (−0.77 to 1.77)	1.19 (−1.16 to 3.54)	4.64 (−0.38 to 9.66)	0.77 (−0.07 to 1.61)	0.070
SBP, mm Hg	0.16 (−0.99 to 1.32)	0.07 (−1.88 to 2.02)	0.54 (−3.65 to 4.74)	0.11 (−0.55 to 0.77)	0.741
DBP, mm Hg	0.40 (−0.47 to 1.27)	1.25 (−0.24 to 2.74)	1.56 (−1.84 to 4.95)	0.52 (0.00 to 1.05)	0.052
Cholesterol, mmol/L	−0.06 (−0.16 to 0.04)	−0.10 (−0.28 to 0.07)	−0.40 (−0.75 to −0.05)	−0.07 (−0.13 to −0.01)	0.017
HDL, mmol/L	−0.03 (−0.07 to 0.01)	−0.10 (−0.19 to 0.00)	−0.13 (−0.31 to 0.06)	−0.04 (−0.07 to −0.01)	0.010
LDL, mmol/L	−0.05 (−0.12 to 0.03)	−0.07 (−0.22 to 0.08)	−0.21 (−0.50 to 0.09)	−0.05 (−0.1 to 0.00)	0.060
Triglycerides, mmol/L†	1.02 (0.97 to 1.08)	1.04 (0.95 to 1.15)	0.94 (0.79 to 1.12)	1.01 (0.98 to 1.05)	0.460
Glucose, mmol/L†	1.00 (0.99 to 1.01)	1.01 (0.99 to 1.03)	1.03 (0.99 to 1.07)	1.00 (1.00 to 1.01)	0.205
Insulin, mg/dL†	1.06 (0.99 to 1.14)	1.22 (1.07 to 1.40)	1.49 (1.16 to 1.92)	1.10 (1.05 to 1.15)	<0.001
CRP, mg/L†	0.99 (0.85 to 1.16)	1.04 (0.80 to 1.34)	1.22 (0.71 to 2.10)	1.02 (0.94 to 1.11)	0.659

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class. BMI indicates body mass index; cholesterol, total cholesterol; CRP, C-reactive protein; DBP, diastolic blood pressure; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; and SBP, systolic blood pressure.

*P value for linear trend.

†Logged outcome variables were back transformed (exponentiated) and are interpreted as the percentage change in those who experienced abuse compared with those who did not experience that abuse or per additional abuse type experienced on the abuse score. In the associations for the score of abuse, 0 (no experience of abuse) is the reference category.

higher triglycerides (β 18%; 95% CI, 6– 31) and CRP (β 31%; 95% CI, 0–72) were evident only in men, whereas the association with lower total cholesterol (β −0.14 mmol/L, 95% CI, −0.27 to −0.02) was observed only in women (Table S7).

When the types of abuse were mutually adjusted, there was evidence of independent associations of physical and sexual abuse with BMI and insulin (Table S8). Adjustment for depression attenuated the point estimates, and associations of all types of abuse with BMI and of physical and sexual abuse with insulin were still evident (Tables S9 through S11). All of the CIs for abuse occurring rarely/sometimes crossed the null value (Table S14). Physical and sexual abuse occurring often/very often were associated with higher BMI (β 1.22 kg/m²; 95%

CI, 0.32–2.12, and 1.56 kg/m², 95% CI, 0.63–2.50, respectively).

A dose-response relationship was observed between a higher score of childhood abuse and higher BMI, higher insulin, lower total cholesterol, and lower HDL (Table 3). For example, each additional experience of abuse was associated with, on average, 10% (95% CI, 5–15) higher insulin, and experiencing all 3 types of abuse was associated with 49% (95% CI, 16–92) higher insulin concentration than those who did not experience any type of abuse. Sex differences were observed for the associations between the summary score of abuse and both triglycerides and CRP at 25 years, with stronger associations observed in men than women (Table S13).

Associations between child abuse and cardiometabolic outcomes at ages 18 and 25 years were similar when including only complete cases, though in the latter CIs were wider because of more imprecision in the estimates (Table S15).

DISCUSSION

This population-based cohort study aimed to assess the associations between childhood abuse and cardiometabolic outcomes in young adults. Childhood abuse (all types and the score of abuse) was consistently associated with higher BMI at 18 and 25 years. At age 25, in addition to associations with BMI, all types of abuse and the score were associated with higher insulin. Additional associations were observed for the specific types of abuse and the abuse score with outcomes at both ages 18 and 25 years (eg, sexual abuse and higher heart rate at ages 18 and 25 and abuse score and lower HDL at 25 years). There was weaker evidence of an association between child abuse and the other cardiometabolic outcomes assessed (eg, point estimates for physical and sexual abuse in relation to diastolic blood pressure were consistently positive at both 18 and 25 years of age, but CIs cross the null). Associations between child abuse and cardiometabolic health outcomes were overall similar if abuse occurred <11 years or between 11 and 17 years. Few associations differed by sex, and when sex differences were evident, men had stronger associations than women.

Although our findings are in line with some previous studies that found positive associations between adverse life events and cardiometabolic risk factors such as obesity and blood pressure,[6,8] not all studies have noted associations between childhood abuse and cardiometabolic health in young adults.[5,7] A cohort study found no evidence for a relationship between child maltreatment and blood pressure or hypertension in young adults,[7] and a systematic review of 20 studies concluded that there was no evidence of an association between childhood adversity and levels of inflammatory and other CVD immune markers in young people.[5] It is possible that some associations differ by cardiometabolic outcomes or are inconsistent because of the different ages, settings, and methods.

A review and meta-analysis of studies investigating the association of childhood maltreatment with obesity found a stronger association for obesity in adulthood (odds ratio [OR], 1.38; 95% CI, 1.28–1.50), compared with obesity in young people (OR, 1.13; 95% CI, 0.92–1.39).[10] In the UK 1958 Birth Cohort, there was no evidence of associations of childhood abuse with BMI at the ages of 16, 23, and 33 years; associations between physical abuse and BMI became apparent at age 45 in men and women and associations with psychological abuse emerged later, at age 50.[9] In our study of a more contemporary birth cohort (1991–1992), associations between all types of abuse in childhood and BMI were already apparent at age 18 and remained at age 25. Furthermore, there was evidence of associations with additional cardiometabolic health measures at ages 18 and 25. These results were overall robust when the types of childhood abuse were mutually adjusted or adjusted for depression, and positive associations with these cardiometabolic outcomes were also observed for a higher score of childhood abuse. Generational differences in obesity levels, frequency and perception of abuse, and chance may play a role in explaining these different findings in the 2 UK cohorts.

Few studies have explored timing-specific effects of abuse on cardiometabolic health,[2] although there is evidence of different associations by timing of abuse on other outcomes.[22–24] We were able to assess childhood abuse experienced <11 years and between 11 and 17 years and found that associations with cardiometabolic health were similar. This corroborates previous findings observed for adult cardiometabolic health.[25] However, we have assessed broad age categories and we cannot be certain that they do not mask differences that would be apparent if we could examine timing of exposure by narrower age ranges/life course stages (eg, early childhood, mid-childhood, early adolescence, and late adolescence).[22] Though recall bias because of retrospective report of childhood abuse could affect the associations by timing of childhood abuse, we would expect such bias to affect associations with all outcomes in the same direction. However, we showed that some associations were stronger for abuse occurring <11 years (eg, the association between psychological abuse and insulin at 25 years), and some were stronger if abuse occurred between 11 and 17 years (eg, the association between physical abuse and heart rate). Therefore, recall bias is unlikely to explain the differences by timing of childhood abuse. Previous evidence for mental health suggests that abuse/maltreatment experienced in adolescence have stronger negative consequences on mental health than does abuse/maltreatment experienced only in childhood.[23,24] Differences by age at abuse in the associations between childhood abuse and cardiometabolic outcomes were still evident when analyses were further adjusted for depression measured using the Short Mood and Feelings Questionnaire (Tables S10 and S11), suggesting that this may not fully explain the age-specific results found.

We also examined abuse in frequency categories. Associations between childhood abuse and cardiometabolic outcomes were driven mainly by those experiencing more frequent abuse. It will be valuable to repeat this analysis at older ages to see whether

adverse cardiometabolic health emerges at a later age in those exposed less frequently or not.

Pathways from abuse in childhood to adverse cardiometabolic health include behavioral, mental health related, and biological mechanisms[2]—these are not necessarily mutually exclusive. For example, exposure to maltreatment can cause emotional dysregulation, which in turn may result in developing maladaptive coping strategies, including emotional eating[26] and subsequent obesity.[27] Childhood abuse may affect cardiometabolic risk through downstream effects on health behaviors (eg, unhealthy diet or physical inactivity), or direct physiological changes resulting from disruption of regulatory pathways, such as the stress response system.[28] Such cascading effects may explain the further emergence of differences in cardiometabolic health at 25 years, as downstream impacts of abuse in childhood on physical health may take time to appear.

Although most associations were similar in men and women, there were stronger associations between childhood abuse and some cardiometabolic outcomes—heart rate, total cholesterol, triglycerides, and CRP—in men. Previous studies assessing associations between childhood maltreatment/victimization with inflammation[29,30] and CVD have shown stronger associations in women,[31,32] others have shown stronger associations with CVD in men,[33,34] whereas some have observed little evidence of sex differences.[35] Further studies of sex differences are needed, as are studies to elucidate sex-specific pathways that can in turn inform sex-specific CVD prevention and treatment.

Strengths and Limitations

This study included a large-scale population cohort with repeated measures of multiple biomarkers of cardiometabolic health. Although most studies do not consider the age at which childhood abuse occurred, we were able to do so and showed no consistent differences by timing at exposure to abuse in the associations with cardiometabolic health.

Our study also has several limitations. One limitation is attrition, which is typical of long-term prospective studies and is more common in those from socioeconomically deprived backgrounds.[36] To minimize selection bias, we conducted multiple imputation to impute missing confounders and outcome data. The similarity between results from the complete case analysis (Table S15) and the analysis of imputed data sets suggests that results are not substantially affected by selection bias.

The sample is predominantly White and relatively affluent, and this may limit generalizability. Nevertheless, the prevalence of childhood abuse found in our study lies within the range of estimates reported in the United Kingdom, where physical abuse ranged from 3.6% to 32.6%, sexual abuse from 0.7% to 27.8%, and psychological abuse from 4.0% to 66.7%.[37]

Abuse was assessed retrospectively by self-report, as is standard in large, population-based studies. However, we used questions that reduce bias by asking about specific acts of violence as opposed to nominal questions about "abuse." Even though ALSPAC has information on childhood abuse collected prospectively, these are mainly reported by the parents and do not cover the entire period before 18 years. Furthermore, the prospective information on different types of abuse was assessed at different time points, so that investigating and comparing the associations of different abuse types by age at exposure would not be possible.

Retrospective report of abuse can be influenced by concurrent mental health factors,[19] and a recent meta-analysis demonstrated poor agreement between prospective and retrospective measures of child abuse, suggesting that these might identify different groups of individuals.[38] Although prospective measures are generally considered more valid and have better specificity,[39] retrospective measures may have better sensitivity. The use of retrospective report of abuse might underestimate associations with objectively measured outcomes, such as cardiometabolic health,[39] and therefore if bias due to retrospective reporting is present, it is likely to have underestimated the associations. It is unlikely that levels of cardiometabolic health markers would influence recall or reporting of childhood abuse. However, mental health and CVD might have a bidirectional relationship,[40] and mental health can influence the report of childhood abuse.[19] Sensitivity analysis adjusting for depression at the time of childhood abuse reporting show overall similar results, and therefore reverse causality in the associations between childhood abuse and cardiometabolic outcomes is unlikely.

We acknowledge that multiple tests have been carried out, which might have increased the risk of type 1 error. Only 12 results would remain evident after formally correcting for multiple testing ($P<7.58\times10^{-4}$) (Table S16). Yet we do not consider each exposure outcome investigated completely independent and we did not use P value thresholds to guide our conclusions. We have interpreted our results with caution, based on patterns of results, the magnitude of estimates, and their CIs, rather than statistical significance.[41]

CONCLUSIONS

Our findings suggest downstream effects of childhood abuse on cardiometabolic risk factors in early adulthood, suggesting that young people who have experienced abuse may benefit from early screening for cardiometabolic health.

Further follow-up with similar cohorts using repeated measures of biomarkers of cardiometabolic health will be valuable in drawing life course trajectories to determine whether these further diverge or otherwise and whether sex differences are observed. Future research into the mechanisms by which early life abuse affects cardiometabolic health may inform secondary prevention efforts.

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Disclosures

None.

Supplementary Material

Data S1
Tables S1–S16
Figure S1

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SUPPLEMENTAL MATERIAL

Data S1.

Supplemental Methods

Childhood abuse

Participants were asked about experiences occurring in childhood (before 11 years), and during adolescence (11-17 years). For the sexual abuse questions (2 items), participants responded with either "No, this did not happen", "Yes, this happened once" or "Yes, this happened more than once". Sexual abuse was coded as 1 if the abuse was reported once or more frequently to at least one question and 0 if reported "no, this did not happen" for both questions. For the physical abuse (4 items) and psychological abuse questions (4 items), participants responded with either: "Never", "Rarely", "Sometimes", "Often", or "Very Often". Responses of "often" and "very often" to questions describing physical and psychological abuse were coded as 1 and responses of "never", "rarely" and "sometimes" were coded as 0.

For sensitivity analysis, childhood abuse was recategorised as "never", "rarely/sometimes" and "often/very often". For sexual abuse, "rarely/sometimes" was defined as sexual abuse that occurred once, and "often/very often" if it occurred more than once. For each type of abuse, if different frequencies were reported for each item, the highest frequency was considered to classify the frequency of abuse occurrence.

Imputation

Analyses were restricted to individuals with data on at least one type of childhood abuse and at least one cardiovascular measure at 18 or 25 years. Multivariate multiple imputation using chained equations was used to impute missing data on childhood abuse, outcomes and covariates. We used 20 imputed data sets and included in the imputation models all variables included in the analysis models. Data on cardiovascular measures at 15 years were also used to inform the imputation.

Table S1. Summary of variable distributions for observed and imputed data (N = 3,223)

	Number of participants with observed values	% missing data	Observed data Mean (SE) for continuous variables, N (%) for categorical variables	Imputed data Mean (SE) for continuous variables, % for categorical variables*
Maternal education, N (%)	2,954	8.3		
CSE			258 (8.7)	8.9
Vocational			209 (7.1)	7.1
O level			1,000 (33.9)	33.8
A level			849 (28.7)	28.7
University degree			638 (21.6)	21.5
Paternal education, N (%)	2,900	10.0		
CSE			436 (15.0)	15.6
Vocational			181 (6.2)	6.3
O level			610 (21.0)	21.0
A level			853 (29.5)	29.2
University degree			820 (28.3)	27.9
Social Class	2,746	14.8		
I			144 (5.2)	5.1
II			804 (29.3)	28.7
III (non-manual)			770 (28.0)	27.6
III (manual)			658 (24.0)	24.0
IV			308 (11.2)	11.9
V			62 (2.3)	2.7
Ethnicity	2,923	9.3		
White			2,818 (96.4)	96.1
Non-white			105 (3.6)	3.9
18-year assessment				
BMI, kg/m^2	2,716	15.7	22.63 (0.08)	22.64 (0.07)
Heart rate, bpm	2,147	33.4	70.06 (0.23)	70.06 (0.23)
SBP, mmHg	2,147	33.4	115.72 (0.25)	115.71 (0.24)
DBP, mmHg	2,147	33.4	64.67 (0.16)	64.65 (0.17)
Total Cholesterol, mmol/L	1,814	43.7	3.78 (0.02)	3.80 (0.01)
HDL, mmol/L	1,814	43.7	1.29 (0.01)	1.30 (0.01)
LDL, mmol/L	1,814	43.7	2.11 (0.01)	2.13 (0.01)
Triglycerides, mmol/L	1,814	43.7	0.83 (0.01)	0.83 (0.01)
Glucose, mmol/L	1,814	43.7	5.03 (0.01)	5.01 (0.01)
Insulin, mg/dL	1,783	44.7	8.07 (0.19)	8.22 (0.15)
CRP, mg/l	1,814	43.7	1.53 (0.09)	1.54 (0.10)
25-year assessment				
BMI, kg/m^2	2,636	18.2	24.75 (0.10)	24.78 (0.09)
Heart rate, bpm	2,147	33.4	70.06 (0.23)	70.19 (0.25)
SBP, mmHg	2,649	17.8	115.45 (0.22)	115.60 (0.21)
DBP, mmHg	2,649	17.8	67.09 (0.15)	67.16 (0.15)
Total Cholesterol, mmol/L	2,157	33.1	4.40 (0.02)	4.40 (0.02)

HDL, mmol/L	2,157	33.1	1.56 (0.01)	1.55 (0.01)
LDL, mmol/L	2,157	33.1	2.41 (0.02)	2.41 (0.02)
Triglycerides, mmol/L	2,157	33.1	0.95 (0.01)	0.96 (0.01)
Glucose, mmol/L	2,157	33.1	5.25 (0.01)	5.25 (0.01)
Insulin, mg/dL	2,157	33.1	9.63 (0.20)	9.85 (0.21)
CRP, mg/l	1,989	38.3	2.22 (0.12)	2.28 (0.29)

*Multivariate multiple imputed data including all participants with information for at least one type of childhood abuse and one cardiometabolic health measure

BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure; HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure

Table S2. Frequency of childhood abuse occurrence (N = 3,223)

	Never % (95% CI)	Rarely/sometimes % (95% CI)	Often/very often % (95% CI)
Males *(n = 1,080)*			
Physical abuse	29.3 (26.5, 32.0)	65.8 (62.9, 68.7)	4.9 (3.5, 6.3)
Sexual abuse	96.6 (95.4, 97.7)	1.1 (0.5, 1.8)	2.3 (1.3, 3.2)
Psychological abuse	12.8 (10.8, 14.8)	77.0 (74.5, 79.6)	10.1 (8.3, 12.0)
Females *(n = 2,143)*			
Physical abuse	38.7 (36.6, 40.7)	56.2 (54.1, 58.3)	5.1 (4.1, 6.1)
Sexual abuse	88.0 (86.6, 89.4)	6.7 (5.6, 7.8)	5.3 (4.3, 6.2)
Psychological abuse	12.9 (11.5, 14.4)	73.3 (71.5, 75.2)	13.7 (12.2, 15.2)
All *(n = 3,223)*			
Physical abuse	35.5 (33.9, 37.2)	59.4 (57.7, 61,1)	5.0 (4.3, 5.8)
Sexual abuse	90.9 (89.9, 91.9)	4.8 (4.1, 5.6)	4.3 (3.5, 5.0)
Psychological abuse	12.9 (11.7, 14.0)	74.6 (73.1, 76.1)	12.5 (11.4, 13.7)

Table S3. Adjusted association between abuse in childhood and cardiometabolic health outcomes at age 18 by age at exposure (N = 3,223)

Type of abuse/ Outcome	Abuse < 11 years β (95% CI)	p	Abuse 11-17 years β (95% CI)	p	p*
Physical abuse					
BMI, kg/m²	1.32 (0.62, 2.02)	<0.001	1.99 (0.04, 3.94)	0.046	0.528
Heart rate, bpm	1.36 (-0.86, 3.58)	0.229	10.50 (3.97, 17.04)	0.002	0.002
SBP, mmHg	0.62 (-1.35, 2.60)	0.534	1.18 (-5.14, 7.50)	0.712	0.863
DBP, mmHg	1.42 (-0.28, 3.12)	0.100	2.43 (-2.17, 7.04)	0.297	0.663
Cholesterol, mmol/L	-0.10 (-0.24, 0.03)	0.140	-0.26 (-0.63, 0.10)	0.156	0.385
HDL, mmol/L	-0.07 (-0.13, -0.01)	0.026	-0.06 (-0.21, 0.09)	0.428	0.925
LDL, mmol/L	-0.02 (-0.15, 0.10)	0.724	-0.18 (-0.52, 0.15)	0.284	0.353
Triglycerides, mmol/L¥	0.96 (0.89, 1.03)	0.242	0.94 (0.77, 1.15)	0.542	0.868
Glucose, mmol/L¥	1.00 (0.98, 1.02)	0.705	1.06 (1.00, 1.12)	0.033	0.044
Insulin, mg/dL¥	0.92 (0.82, 1.03)	0.165	1.23 (0.84, 1.79)	0.281	0.143
CRP, mg/l¥	1.29 (1.00, 1.66)	0.053	2.19 (1.14, 4.19)	0.018	0.133
Sexual abuse					
BMI, kg/m²	0.65 (-0.12, 1.43)	0.096	0.64 (0.01, 1.26)	0.046	0.969
Heart rate, bpm	1.91 (-0.64, 4.45)	0.141	1.40 (-0.45, 3.25)	0.137	0.740
SBP, mmHg	1.36 (-1.20, 3.92)	0.293	-0.37 (-2.13, 1.39)	0.680	0.203
DBP, mmHg	0.69 (-1.36, 2.74)	0.502	0.46 (-0.81, 1.73)	0.472	0.844
Cholesterol, mmol/L	0.03 (-0.13, 0.20)	0.694	-0.01 (-0.15, 0.12)	0.844	0.631
HDL, mmol/L	-0.04 (-0.10, 0.02)	0.230	0.01 (-0.05, 0.08)	0.685	0.248
LDL, mmol/L	0.09 (-0.06, 0.25)	0.223	-0.03 (-0.14, 0.08)	0.627	0.166
Triglycerides, mmol/L¥	0.95 (0.86, 1.06)	0.373	0.99 (0.91, 1.07)	0.810	0.520
Glucose, mmol/L¥	0.99 (0.97, 1.02)	0.479	1.00 (0.98, 1.01)	0.603	0.753
Insulin, mg/dL¥	0.95 (0.84, 1.08)	0.418	0.97 (0.87, 1.07)	0.539	0.769
CRP, mg/l¥	1.19 (0.87, 1.63)	0.266	0.96 (0.73, 1.27)	0.790	0.309
Psychological abuse					
BMI, kg/m²	0.77 (-0.76, 2.30)	0.324	0.48 (0.03, 0.93)	0.036	0.693
Heart rate, bpm	3.66 (-0.72, 8.04)	0.101	0.53 (-0.83, 1.89)	0.447	0.218
SBP, mmHg	-0.12 (-4.40, 4.15)	0.955	-0.23 (-1.57, 1.11)	0.734	0.960
DBP, mmHg	-0.06 (-3.13, 3.00)	0.967	-0.10 (-1.09, 0.88)	0.836	0.978
Cholesterol, mmol/L	-0.12 (-0.42, 0.19)	0.461	-0.04 (-0.13, 0.05)	0.363	0.636
HDL, mmol/L	-0.05 (-0.17, 0.08)	0.479	-0.01 (-0.05, 0.03)	0.686	0.541
LDL, mmol/L	-0.05 (-0.33, 0.23)	0.728	-0.02 (-0.10, 0.06)	0.540	0.862
Triglycerides, mmol/L¥	0.98 (0.84, 1.15)	0.838	0.98 (0.94, 1.02)	0.321	0.950
Glucose, mmol/L¥	1.04 (1.00, 1.09)	0.059	1.01 (1.00, 1.02)	0.258	0.140
Insulin, mg/dL¥	1.05 (0.81, 1.37)	0.707	1.04 (0.96, 1.13)	0.308	0.951
CRP, mg/l¥	1.02 (0.62, 1.69)	0.931	1.18 (0.99, 1.39)	0.059	0.617

p* p-value for the difference between estimates for abuse <11 years and abuse 11-17 years.
Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
¥ these results should be interpreted as percent change

Table S4. Adjusted association between timing of abuse in childhood and cardiometabolic health outcomes at age 25 by age at exposure (N = 3,223)

Type of abuse/ Outcome	Abuse < 11 years		Abuse 11-17 years		
	β (95% CI)	p	β (95% CI)	p	p*
Physical abuse					
BMI, kg/m^2	1.43 (0.56, 2.29)	0.001	4.43 (1.57, 7.28)	0.003	0.049
Heart rate, bpm	1.24 (-1.20, 3.67)	0.314	9.59 (3.28, 15.90)	0.003	0.006
SBP, mmHg	0.02 (-1.88, 1.92)	0.983	2.02 (-4.15, 8.20)	0.517	0.500
DBP, mmHg	1.19 (-0.25, 2.64)	0.105	4.20 (-0.91, 9.30)	0.105	0.230
Cholesterol, mmol/L	-0.12 (-0.28, 0.04)	0.144	-0.25 (-0.77, 0.27)	0.352	0.644
HDL, mmol/L	-0.09 (-0.17, 0.00)	0.039	-0.28 (-0.57, 0.01)	0.058	0.170
LDL, mmol/L	-0.05 (-0.18, 0.08)	0.425	0.05 (-0.37, 0.47)	0.820	0.662
Triglycerides, mmol/L$^¥$	1.01 (0.93, 1.11)	0.753	0.89 (0.69, 1.14)	0.336	0.271
Glucose, mmol/L$^¥$	1.01 (0.99, 1.03)	0.251	1.06 (0.99, 1.14)	0.096	0.186
Insulin, mg/dL$^¥$	1.25 (1.12, 1.41)	<0.001	1.75 (1.14, 2.69)	0.011	0.118
CRP, mg/l$^¥$	1.20 (0.95, 1.52)	0.123	1.96 (0.85, 4.49)	0.110	0.296
Sexual abuse					
BMI, kg/m^2	1.03 (0.11, 1.96)	0.028	0.93 (0.18, 1.68)	0.015	0.871
Heart rate, bpm	0.99 (-1.58, 3.57)	0.445	1.58 (-0.22, 3.38)	0.086	0.702
SBP, mmHg	0.89 (-1.03, 2.81)	0.363	0.32 (-1.27, 1.91)	0.693	0.593
DBP, mmHg	1.31 (-0.22, 2.85)	0.093	0.45 (-0.85, 1.76)	0.493	0.381
Cholesterol, mmol/L	-0.10 (-0.27, 0.08)	0.274	-0.13 (-0.28, 0.02)	0.087	0.717
HDL, mmol/L	-0.09 (-0.18, 0.00)	0.060	-0.04 (-0.12, 0.04)	0.336	0.305
LDL, mmol/L	0.01 (-0.14, 0.16)	0.884	-0.10 (-0.23, 0.03)	0.144	0.207
Triglycerides, mmol/L$^¥$	0.98 (0.90, 1.07)	0.629	1.04 (0.97, 1.13)	0.269	0.185
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.777	1.00 (0.98, 1.02)	0.825	0.925
Insulin, mg/dL$^¥$	1.14 (1.00, 1.30)	0.051	1.12 (1.01, 1.23)	0.027	0.790
CRP, mg/l$^¥$	1.14 (0.87, 1.50)	0.349	1.06 (0.87, 1.29)	0.571	0.650
Psychological abuse					
BMI, kg/m^2	1.62 (-0.39, 3.64)	0.114	0.83 (0.26, 1.39)	0.004	0.463
Heart rate, bpm	3.44 (-1.31, 8.20)	0.155	0.52 (-0.98, 2.02)	0.495	0.234
SBP, mmHg	1.24 (-2.75, 5.24)	0.541	0.03 (-1.16, 1.23)	0.954	0.546
DBP, mmHg	1.27 (-2.00, 4.54)	0.444	0.42 (-0.47, 1.32)	0.353	0.643
Cholesterol, mmol/L	-0.15 (-0.52, 0.23)	0.438	-0.05 (-0.16, 0.05)	0.311	0.633
HDL, mmol/L	-0.19 (-0.38, 0.00)	0.051	-0.05 (-0.10, 0.00)	0.071	0.130
LDL, mmol/L	0.02 (-0.34, 0.39)	0.897	-0.05 (-0.14, 0.04)	0.244	0.683
Triglycerides, mmol/L$^¥$	1.04 (0.86, 1.26)	0.695	1.02 (0.96, 1.07)	0.582	0.826
Glucose, mmol/L$^¥$	1.06 (1.01, 1.11)	0.016	1.01 (1.00, 1.03)	0.102	0.049
Insulin, mg/dL$^¥$	1.51 (1.15, 1.97)	0.003	1.09 (1.00, 1.19)	0.051	0.011
CRP, mg/l$^¥$	1.03 (0.56, 1.90)	0.929	0.90 (0.77, 1.05)	0.170	0.674

p* p-value for the difference between estimates for abuse <11 years and abuse 11-17 years.
Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S5. Unadjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years (N = 3,223)

	18 years		25 years	
	β (95% CI)	p-value	β (95% CI)	p-value
Physical abuse				
BMI, kg/m^2	1.46 (0.77, 2.16)	<0.001	1.71 (0.85, 2.57)	<0.001
Heart rate, bpm	1.23 (-1.02, 3.48)	0.284	1.48 (-0.95, 3.92)	0.228
SBP, mmHg	0.83 (-1.26, 2.91)	0.437	-0.09 (-2.11, 1.94)	0.932
DBP, mmHg	1.66 (0.01, 3.31)	0.049	1.28 (-0.15, 2.71)	0.079
Cholesterol, mmol/L	-0.10 (-0.24, 0.04)	0.150	-0.11 (-0.27, 0.05)	0.179
HDL, mmol/L	-0.07 (-0.13, -0.01)	0.019	-0.09 (-0.18, -0.01)	0.030
LDL, mmol/L	-0.02 (-0.15, 0.11)	0.764	-0.04 (-0.17, 0.09)	0.520
Triglycerides, mmol/L$^¥$	0.96 (0.89, 1.03)	0.296	1.01 (0.93, 1.11)	0.759
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.774	1.01 (0.99, 1.04)	0.218
Insulin, mg/dL$^¥$	0.95 (0.85, 1.06)	0.343	1.28 (1.14, 1.44)	<0.001
CRP, mg/l$^¥$	1.34 (1.03, 1.73)	0.028	1.27 (1.01, 1.60)	0.043
Sexual abuse				
BMI, kg/m^2	0.72 (0.19, 1.25)	0.008	1.03 (0.38, 1.67)	0.002
Heart rate, bpm	3.31 (1.66, 4.97)	<0.001	2.75 (1.17, 4.32)	0.001
SBP, mmHg	-2.07 (-3.82, -0.32)	0.021	-1.98 (-3.45, -0.50)	0.009
DBP, mmHg	0.77 (-0.40, 1.95)	0.193	0.70 (-0.38, 1.79)	0.204
Cholesterol, mmol/L	0.11 (-0.01, 0.23)	0.080	-0.09 (-0.21, 0.04)	0.173
HDL, mmol/L	0.03 (-0.01, 0.07)	0.179	0.01 (-0.06, 0.08)	0.859
LDL, mmol/L	0.08 (-0.02, 0.18)	0.125	-0.06 (-0.16, 0.04)	0.236
Triglycerides, mmol/L$^¥$	0.99 (0.92, 1.06)	0.746	1.00 (0.94, 1.07)	0.943
Glucose, mmol/L$^¥$	0.98 (0.97, 1.00)	0.036	0.99 (0.97, 1.00)	0.061
Insulin, mg/dL$^¥$	1.02 (0.93, 1.12)	0.663	1.17 (1.08, 1.28)	<0.001
CRP, mg/l$^¥$	1.14 (0.93, 1.40)	0.204	1.27 (1.06, 1.52)	0.009
Psychological abuse				
BMI, kg/m^2	0.57 (0.12, 1.02)	0.013	0.93 (0.37, 1.49)	0.001
Heart rate, bpm	0.89 (-0.50, 2.27)	0.209	0.90 (-0.65, 2.44)	0.251
SBP, mmHg	-0.90 (-2.34, 0.55)	0.222	-0.74 (-2.05, 0.57)	0.268
DBP, mmHg	-0.03 (-1.01, 0.95)	0.955	0.40 (-0.48, 1.29)	0.372
Cholesterol, mmol/L	-0.02 (-0.11, 0.08)	0.724	-0.05 (-0.16, 0.05)	0.321
HDL, mmol/L	0.00 (-0.04, 0.04)	0.972	-0.03 (-0.09, 0.02)	0.212
LDL, mmol/L	-0.01 (-0.09, 0.07)	0.811	-0.05 (-0.14, 0.04)	0.272
Triglycerides, mmol/L$^¥$	0.98 (0.94, 1.03)	0.422	1.01 (0.96, 1.07)	0.691
Glucose, mmol/L$^¥$	1.00 (0.99, 1.01)	0.523	1.01 (0.99, 1.02)	0.219
Insulin, mg/dL$^¥$	1.06 (0.98, 1.16)	0.132	1.11 (1.02, 1.21)	0.015
CRP, mg/l$^¥$	1.22 (1.03, 1.44)	0.022	0.95 (0.81, 1.11)	0.488

BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure; HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S6. Adjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years (N = 3,223)

	18 years		25 years	
	β (95% CI)	p-value	β (95% CI)	p-value
Physical abuse				
BMI, kg/m^2	1.35 (0.66, 2.05)	<0.001	1.47 (0.61, 2.33)	0.001
Heart rate, bpm	1.37 (-0.85, 3.58)	0.226	1.35 (-1.03, 3.73)	0.262
SBP, mmHg	0.66 (-1.34, 2.65)	0.517	-0.05 (-1.98, 1.88)	0.960
DBP, mmHg	1.41 (-0.24, 3.06)	0.093	1.17 (-0.27, 2.61)	0.111
Cholesterol, mmol/L	-0.11 (-0.24, 0.03)	0.126	-0.14 (-0.30, 0.02)	0.097
HDL, mmol/L	-0.07 (-0.13, -0.01)	0.024	-0.09 (-0.17, -0.01)	0.036
LDL, mmol/L	-0.03 (-0.15, 0.10)	0.678	-0.06 (-0.19, 0.06)	0.340
Triglycerides, mmol/L$^¥$	0.96 (0.89, 1.03)	0.252	1.01 (0.93, 1.10)	0.853
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.747	1.01 (0.99, 1.03)	0.237
Insulin, mg/dL$^¥$	0.93 (0.83, 1.04)	0.187	1.26 (1.12, 1.41)	<0.001
CRP, mg/l$^¥$	1.31 (1.01, 1.69)	0.041	1.22 (0.97, 1.53)	0.088
Sexual abuse				
BMI, kg/m^2	0.57 (0.04, 1.11)	0.036	0.89 (0.24, 1.54)	0.008
Heart rate, bpm	1.92 (0.26, 3.58)	0.023	1.62 (0.04, 3.20)	0.044
SBP, mmHg	0.39 (-1.25, 2.03)	0.636	0.50 (-0.83, 1.84)	0.459
DBP, mmHg	0.70 (-0.47, 1.87)	0.242	0.89 (-0.20, 1.98)	0.109
Cholesterol, mmol/L	0.02 (-0.10, 0.15)	0.728	-0.14 (-0.26, -0.01)	0.032
HDL, mmol/L	0.00 (-0.05, 0.04)	0.870	-0.05 (-0.12, 0.02)	0.150
LDL, mmol/L	0.03 (-0.07, 0.13)	0.562	-0.07 (-0.18, 0.03)	0.171
Triglycerides, mmol/L$^¥$	0.98 (0.92, 1.05)	0.609	1.03 (0.96, 1.09)	0.432
Glucose, mmol/L$^¥$	0.99 (0.98, 1.01)	0.366	1.00 (0.98, 1.01)	0.652
Insulin, mg/dL$^¥$	0.97 (0.89, 1.06)	0.481	1.13 (1.03, 1.23)	0.007
CRP, mg/l$^¥$	1.04 (0.84, 1.27)	0.736	1.12 (0.93, 1.34)	0.230
Psychological abuse				
BMI, kg/m^2	0.47 (0.01, 0.92)	0.043	0.80 (0.24, 1.37)	0.005
Heart rate, bpm	0.49 (-0.86, 1.85)	0.477	0.51 (-1.02, 2.04)	0.511
SBP, mmHg	-0.27 (-1.60, 1.07)	0.693	-0.02 (-1.21, 1.17)	0.974
DBP, mmHg	-0.11 (-1.09, 0.86)	0.820	0.39 (-0.50, 1.28)	0.394
Cholesterol, mmol/L	-0.04 (-0.14, 0.05)	0.352	-0.06 (-0.17, 0.04)	0.241
HDL, mmol/L	-0.01 (-0.05, 0.03)	0.695	-0.05 (-0.10, 0.01)	0.079
LDL, mmol/L	-0.03 (-0.11, 0.05)	0.522	-0.06 (-0.15, 0.03)	0.191
Triglycerides, mmol/L$^¥$	0.98 (0.94, 1.02)	0.310	1.02 (0.96, 1.07)	0.597
Glucose, mmol/L$^¥$	1.01 (1.00, 1.02)	0.264	1.01 (1.00, 1.03)	0.099
Insulin, mg/dL$^¥$	1.04 (0.96, 1.13)	0.325	1.09 (1.00, 1.19)	0.048
CRP, mg/l$^¥$	1.17 (0.99, 1.38)	0.069	0.90 (0.77, 1.05)	0.164

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S7. Adjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years in males and females (N = 3,223)

| | 18 years | | | 25 years | | |
	Males β (95% CI)	Females β (95% CI)	p-value sex interaction	Males β (95% CI)	Females β (95% CI)	p-value sex interaction
Physical abuse						
BMI, kg/m^2	0.70 (-0.35, 1.75)	1.66 (0.76, 2.57)	0.193	1.07 (-0.35, 2.49)	1.68 (0.60, 2.76)	0.412
Heart rate, bpm	1.31 (-2.44, 5.06)	1.36 (-1.45, 4.17)	0.867	0.94 (-2.58, 4.46)	1.53 (-1.72, 4.77)	0.701
SBP, mmHg	-0.25 (-3.99, 3.49)	1.10 (-1.70, 3.90)	0.635	-1.61 (-5.52, 2.31)	0.73 (-1.29, 2.76)	0.219
DBP, mmHg	0.34 (-2.25, 2.93)	1.89 (-0.18, 3.95)	0.329	0.13 (-2.55, 2.80)	1.70 (0.09, 3.31)	0.256
Cholesterol, mmol/L	-0.13 (-0.34, 0.08)	-0.09 (-0.27, 0.09)	0.736	-0.16 (-0.45, 0.13)	-0.12 (-0.31, 0.07)	0.807
HDL, mmol/L	-0.11 (-0.20, -0.01)	-0.05 (-0.13, 0.02)	0.531	-0.12 (-0.26, 0.02)	-0.07 (-0.18, 0.03)	0.723
LDL, mmol/L	0.00 (-0.18, 0.18)	-0.03 (-0.20, 0.13)	0.917	-0.04 (-0.29, 0.21)	-0.07 (-0.23, 0.09)	0.942
Triglycerides, mmol/L$^¥$	0.92 (0.81, 1.04)	0.98 (0.89, 1.07)	0.370	1.03 (0.87, 1.22)	1.00 (0.92, 1.10)	0.965
Glucose, mmol/L$^¥$	1.00 (0.96, 1.03)	1.00 (0.97, 1.02)	0.961	1.01 (0.97, 1.05)	1.01 (0.99, 1.04)	0.846
Insulin, mg/dL$^¥$	0.91 (0.77, 1.09)	0.94 (0.82, 1.07)	0.690	1.25 (0.98, 1.59)	1.28 (1.12, 1.45)	0.679
CRP, mg/l$^¥$	1.13 (0.76, 1.69)	1.41 (1.01, 1.97)	0.395	1.05 (0.70, 1.59)	1.31 (0.99, 1.72)	0.459
Sexual abuse						
BMI, kg/m^2	2.15 (0.62, 3.68)	0.33 (-0.26, 0.93)	0.052	1.43 (-0.15, 3.01)	0.78 (0.05, 1.51)	0.629
Heart rate, bpm	8.07 (2.02, 14.12)	1.25 (-0.43, 2.93)	0.033	4.28 (-2.15, 10.72)	1.14 (-0.42, 2.69)	0.372
SBP, mmHg	2.46 (-4.26, 9.18)	0.05 (-1.66, 1.76)	0.443	0.91 (-3.25, 5.06)	0.42 (-0.94, 1.77)	0.936
DBP, mmHg	4.45 (-0.07, 8.96)	0.09 (-1.08, 1.26)	0.073	2.58 (-0.54, 5.71)	0.62 (-0.52, 1.76)	0.319
Cholesterol, mmol/L	0.15 (-0.12, 0.43)	0.00 (-0.13, 0.13)	0.355	-0.09 (-0.42, 0.25)	-0.15 (-0.28, -0.01)	0.761
HDL, mmol/L	-0.11 (-0.24, 0.03)	0.02 (-0.04, 0.07)	0.110	-0.06 (-0.20, 0.07)	-0.04 (-0.12, 0.03)	0.797
LDL, mmol/L	0.17 (-0.09, 0.43)	0.01 (-0.11, 0.12)	0.286	0.04 (-0.26, 0.33)	-0.09 (-0.21, 0.02)	0.451
Triglycerides, mmol/L$^¥$	1.10 (0.87, 1.39)	0.96 (0.90, 1.03)	0.281	1.02 (0.84, 1.23)	1.02 (0.96, 1.09)	0.974
Glucose, mmol/L$^¥$	0.98 (0.92, 1.03)	1.00 (0.98, 1.01)	0.462	0.99 (0.95, 1.04)	1.00 (0.98, 1.01)	0.781
Insulin, mg/dL$^¥$	1.25 (0.93, 1.66)	0.93 (0.85, 1.02)	0.083	1.12 (0.88, 1.44)	1.12 (1.02, 1.23)	0.911
CRP, mg/l$^¥$	1.35 (0.69, 2.63)	0.99 (0.79, 1.24)	0.443	1.43 (0.90, 2.30)	1.08 (0.89, 1.31)	0.339
Psychological abuse						
BMI, kg/m^2	0.80 (0.04, 1.56)	0.31 (-0.24, 0.86)	0.314	1.25 (0.35, 2.16)	0.63 (-0.08, 1.33)	0.378
Heart rate, bpm	1.39 (-1.24, 4.02)	0.08 (-1.50, 1.67)	0.412	1.77 (-0.96, 4.49)	-0.01 (-1.70, 1.68)	0.281
SBP, mmHg	0.49 (-2.25, 3.23)	-0.62 (-2.17, 0.94)	0.386	-0.26 (-2.54, 2.03)	0.06 (-1.29, 1.41)	0.762
DBP, mmHg	-0.21 (-2.16, 1.73)	-0.15 (-1.25, 0.95)	0.996	0.43 (-1.40, 2.26)	0.34 (-0.69, 1.36)	0.941
Cholesterol, mmol/L	0.05 (-0.09, 0.18)	-0.08 (-0.2, 0.04)	0.231	0.13 (-0.06, 0.32)	-0.14 (-0.27, -0.02)	0.028
HDL, mmol/L	-0.03 (-0.09, 0.04)	0.00 (-0.05, 0.05)	0.596	-0.08 (-0.16, -0.01)	-0.03 (-0.10, 0.03)	0.360

LDL, mmol/L	0.09 (-0.04, 0.21)	-0.07 (-0.17, 0.03)	0.091	0.08 (-0.10, 0.26)	-0.11 (-0.22, 0.00)	0.118
Triglycerides, mmol/L$^{¥}$	0.96 (0.88, 1.05)	0.98 (0.93, 1.04)	0.748	1.18 (1.06, 1.31)	0.96 (0.90, 1.03)	0.002
Glucose, mmol/L$^{¥}$	1.01 (0.99, 1.04)	1.00 (0.99, 1.02)	0.627	1.02 (1.00, 1.05)	1.01 (0.99, 1.02)	0.242
Insulin, mg/dL$^{¥}$	0.95 (0.83, 1.08)	1.08 (0.98, 1.18)	0.083	1.15 (0.99, 1.33)	1.07 (0.97, 1.19)	0.512
CRP, mg/l $^{¥}$	1.25 (0.96, 1.63)	1.14 (0.92, 1.40)	0.612	1.31 (1.00, 1.72)	0.76 (0.64, 0.91)	0.001

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class

BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein

$^{¥}$ these results should be interpreted as percent change

Table S8. Adjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years, with types of abuse mutually adjusted (N = 3,223)

| | 18 years | | 25 years | |
	β (95% CI)	P-value	β (95% CI)	P-value
Physical abuse				
BMI, kg/m^2	1.22 (0.47, 1.97)	0.001	1.11 (0.17, 2.06)	0.021
Heart rate, bpm	1.10 (-1.27, 3.46)	0.364	1.09 (-1.42, 3.60)	0.390
SBP, mmHg	0.89 (-1.18, 2.96)	0.397	-0.09 (-2.36, 2.17)	0.935
DBP, mmHg	1.64 (-0.11, 3.39)	0.066	1.03 (-0.56, 2.61)	0.203
Cholesterol, mmol/L	-0.10 (-0.24, 0.04)	0.177	-0.10 (-0.28, 0.07)	0.244
HDL, mmol/L	-0.07 (-0.14, -0.01)	0.020	-0.07 (-0.16, 0.02)	0.142
LDL, mmol/L	-0.02 (-0.15, 0.12)	0.799	-0.03 (-0.17, 0.12)	0.719
Triglycerides, mmol/L$^¥$	0.97 (0.89, 1.05)	0.414	1.00 (0.91, 1.09)	0.957
Glucose, mmol/L$^¥$	0.99 (0.97, 1.01)	0.498	1.01 (0.99, 1.03)	0.519
Insulin, mg/dL$^¥$	0.90 (0.79, 1.02)	0.099	1.22 (1.08, 1.39)	0.002
CRP, mg/l$^¥$	1.23 (0.93, 1.63)	0.137	1.33 (1.04, 1.71)	0.025
Sexual abuse				
BMI, kg/m^2	0.46 (-0.08, 1.00)	0.097	0.73 (0.07, 1.39)	0.029
Heart rate, bpm	1.83 (0.15, 3.52)	0.033	1.52 (-0.11, 3.14)	0.067
SBP, mmHg	0.39 (-1.23, 2.01)	0.634	0.52 (-0.83, 1.86)	0.450
DBP, mmHg	0.64 (-0.54, 1.82)	0.287	0.80 (-0.30, 1.90)	0.153
Cholesterol, mmol/L	0.03 (-0.09, 0.16)	0.597	-0.12 (-0.25, 0.00)	0.052
HDL, mmol/L	0.00 (-0.04, 0.05)	0.965	-0.04 (-0.11, 0.03)	0.240
LDL, mmol/L	0.04 (-0.07, 0.14)	0.500	-0.07 (-0.17, 0.04)	0.231
Triglycerides, mmol/L$^¥$	0.99 (0.92, 1.06)	0.705	1.02 (0.96, 1.09)	0.461
Glucose, mmol/L$^¥$	0.99 (0.97, 1.01)	0.326	0.99 (0.98, 1.01)	0.477
Insulin, mg/dL$^¥$	0.97 (0.89, 1.06)	0.468	1.10 (1.01, 1.21)	0.027
CRP, mg/l$^¥$	1.00 (0.82, 1.23)	0.973	1.12 (0.93, 1.34)	0.226
Psychological abuse				
BMI, kg/m^2	0.13 (-0.36, 0.62)	0.616	0.46 (-0.16, 1.08)	0.144
Heart rate, bpm	0.05 (-1.40, 1.50)	0.949	0.09 (-1.51, 1.70)	0.909
SBP, mmHg	-0.52 (-1.92, 0.88)	0.463	-0.05 (-1.46, 1.36)	0.945
DBP, mmHg	-0.57 (-1.60, 0.46)	0.275	0.06 (-0.93, 1.05)	0.904
Cholesterol, mmol/L	-0.02 (-0.12, 0.07)	0.636	-0.02 (-0.14, 0.09)	0.719
HDL, mmol/L	0.01 (-0.03, 0.05)	0.639	-0.03 (-0.08, 0.03)	0.382
LDL, mmol/L	-0.03 (-0.11, 0.06)	0.559	-0.05 (-0.15, 0.05)	0.354
Triglycerides, mmol/L$^¥$	0.99 (0.94, 1.03)	0.584	1.01 (0.96, 1.08)	0.658
Glucose, mmol/L$^¥$	1.01 (1.00, 1.02)	0.125	1.01 (1.00, 1.03)	0.165
Insulin, mg/dL$^¥$	1.07 (0.98, 1.17)	0.131	1.03 (0.94, 1.14)	0.538
CRP, mg/l$^¥$	1.11 (0.92, 1.34)	0.273	0.83 (0.70, 0.98)	0.029

Adjusted for age, sex, ethnicity, maternal education, paternal education, parental social class, and other types of abuse

BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure; HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure

$^¥$ these results should be interpreted as percent change

Table S9. Adjusted association (including depression) between child abuse and cardiometabolic outcomes at 18 and 25 years

	18 years		25 years	
	β (95% CI)	P-value	β (95% CI)	P-value
Physical abuse				
BMI, kg/m^2	1.20 (0.50, 1.90)	0.001	1.16 (0.29, 2.03)	0.009
Heart rate, bpm	1.14 (-1.11, 3.39)	0.320	1.09 (-1.26, 3.44)	0.359
SBP, mmHg	0.76 (-1.26, 2.79)	0.458	-0.08 (-2.04, 1.89)	0.938
DBP, mmHg	1.50 (-0.19, 3.19)	0.081	0.91 (-0.53, 2.36)	0.215
Cholesterol, mmol/L	-0.10 (-0.25, 0.04)	0.159	-0.12 (-0.28, 0.04)	0.151
HDL, mmol/L	-0.06 (-0.12, 0.00)	0.045	-0.07 (-0.15, 0.01)	0.100
LDL, mmol/L	-0.03 (-0.16, 0.10)	0.644	-0.06 (-0.19, 0.07)	0.351
Triglycerides, mmol/L$^¥$	0.95 (0.89, 1.03)	0.209	1.01 (0.92, 1.10)	0.882
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.759	1.01 (0.99, 1.03)	0.314
Insulin, mg/dL$^¥$	0.90 (0.80, 1.01)	0.083	1.23 (1.10, 1.38)	<0.001
CRP, mg/l$^¥$	1.29 (0.99, 1.68)	0.056	1.23 (0.97, 1.55)	0.083
Sexual abuse				
BMI, kg/m^2	0.46 (-0.08, 1.00)	0.097	0.66 (0.00, 1.32)	0.049
Heart rate, bpm	1.79 (0.11, 3.47)	0.037	1.45 (-0.14, 3.04)	0.074
SBP, mmHg	0.46 (-1.17, 2.10)	0.577	0.49 (-0.85, 1.83)	0.471
DBP, mmHg	0.75 (-0.42, 1.91)	0.208	0.71 (-0.39, 1.81)	0.204
Cholesterol, mmol/L	0.03 (-0.10, 0.15)	0.668	-0.13 (-0.25, 0.00)	0.050
HDL, mmol/L	0.00 (-0.04, 0.05)	0.925	-0.04 (-0.10, 0.03)	0.299
LDL, mmol/L	0.03 (-0.08, 0.13)	0.594	-0.07 (-0.18, 0.03)	0.170
Triglycerides, mmol/L$^¥$	0.98 (0.92, 1.05)	0.549	1.02 (0.96, 1.09)	0.456
Glucose, mmol/L$^¥$	0.99 (0.97, 1.01)	0.364	1.00 (0.98, 1.01)	0.527
Insulin, mg/dL$^¥$	0.95 (0.87, 1.04)	0.269	1.11 (1.02, 1.21)	0.022
CRP, mg/l$^¥$	1.02 (0.83, 1.27)	0.831	1.12 (0.94, 1.34)	0.213
Psychological abuse				
BMI, kg/m^2	0.34 (-0.13, 0.81)	0.156	0.57 (0.00, 1.14)	0.052
Heart rate, bpm	0.31 (-1.08, 1.70)	0.657	0.30 (-1.22, 1.82)	0.694
SBP, mmHg	-0.21 (-1.58, 1.16)	0.763	-0.04 (-1.23, 1.15)	0.945
DBP, mmHg	-0.08 (-1.06, 0.91)	0.878	0.19 (-0.72, 1.09)	0.690
Cholesterol, mmol/L	-0.04 (-0.14, 0.06)	0.409	-0.05 (-0.16, 0.06)	0.362
HDL, mmol/L	0.00 (-0.04, 0.04)	0.937	-0.03 (-0.08, 0.02)	0.236
LDL, mmol/L	-0.03 (-0.11, 0.05)	0.484	-0.06 (-0.15, 0.03)	0.192
Triglycerides, mmol/L$^¥$	0.97 (0.93, 1.02)	0.250	1.01 (0.96, 1.08)	0.628
Glucose, mmol/L$^¥$	1.01 (1.00, 1.02)	0.261	1.01 (1.00, 1.03)	0.142
Insulin, mg/dL$^¥$	1.02 (0.94, 1.11)	0.606	1.07 (0.98, 1.17)	0.125
CRP, mg/l$^¥$	1.16 (0.97, 1.38)	0.102	0.89 (0.76, 1.05)	0.169

Adjusted for age, sex, ethnicity, maternal education, paternal education, parental social class, and depression.
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S10. Adjusted association (including depression) between abuse in childhood and cardiometabolic health outcomes at age 18 by age at exposure (N = 3,223)

Type of abuse/ Outcome	Abuse < 11 years β (95% CI)	p	Abuse 11-17 years β (95% CI)	p	p*
Physical abuse					
BMI, kg/m^2	1.16 (0.45, 1.87)	0.001	1.80 (-0.17, 3.76)	0.073	0.550
Heart rate, bpm	1.13 (-1.13, 3.39)	0.326	10.26 (3.71, 16.80)	0.002	0.002
SBP, mmHg	0.73 (-1.28, 2.75)	0.473	1.28 (-5.09, 7.64)	0.692	0.867
DBP, mmHg	1.51 (-0.24, 3.26)	0.090	2.50 (-2.08, 7.07)	0.282	0.674
Cholesterol, mmol/L	-0.10 (-0.24, 0.04)	0.176	-0.26 (-0.62, 0.11)	0.165	0.390
HDL, mmol/L	-0.06 (-0.12, 0.00)	0.048	-0.05 (-0.20, 0.10)	0.496	0.904
LDL, mmol/L	-0.03 (-0.16, 0.11)	0.690	-0.19 (-0.53, 0.15)	0.277	0.354
Triglycerides, mmol/L$^¥$	0.95 (0.88, 1.03)	0.201	0.94 (0.76, 1.14)	0.514	0.871
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.717	1.06 (1.00, 1.12)	0.033	0.044
Insulin, mg/dL$^¥$	0.90 (0.80, 1.01)	0.072	1.20 (0.82, 1.75)	0.351	0.143
CRP, mg/l$^¥$	1.27 (0.98, 1.65)	0.073	2.15 (1.13, 4.10)	0.021	0.140
Sexual abuse					
BMI, kg/m^2	0.54 (-0.23, 1.32)	0.169	0.50 (-0.13, 1.13)	0.117	0.931
Heart rate, bpm	1.80 (-0.75, 4.34)	0.166	1.23 (-0.64, 3.10)	0.198	0.709
SBP, mmHg	1.43 (-1.11, 3.96)	0.266	-0.31 (-2.09, 1.47)	0.735	0.209
DBP, mmHg	0.73 (-1.31, 2.76)	0.477	0.51 (-0.77, 1.80)	0.430	0.855
Cholesterol, mmol/L	0.04 (-0.13, 0.21)	0.657	-0.01 (-0.15, 0.13)	0.900	0.638
HDL, mmol/L	-0.03 (-0.10, 0.03)	0.296	0.02 (-0.04, 0.08)	0.530	0.235
LDL, mmol/L	0.09 (-0.06, 0.25)	0.236	-0.03 (-0.15, 0.08)	0.591	0.164
Triglycerides, mmol/L$^¥$	0.95 (0.86, 1.06)	0.344	0.99 (0.91, 1.07)	0.755	0.534
Glucose, mmol/L$^¥$	0.99 (0.97, 1.02)	0.479	1.00 (0.98, 1.01)	0.607	0.757
Insulin, mg/dL$^¥$	0.94 (0.83, 1.06)	0.283	0.95 (0.85, 1.05)	0.316	0.824
CRP, mg/l$^¥$	1.18 (0.86, 1.62)	0.296	0.95 (0.72, 1.26)	0.716	0.304
Psychological abuse					
BMI, kg/m^2	0.58 (-0.96, 2.12)	0.461	0.36 (-0.11, 0.82)	0.135	0.763
Heart rate, bpm	3.43 (-0.98, 7.83)	0.127	0.35 (-1.04, 1.75)	0.620	0.232
SBP, mmHg	-0.04 (-4.35, 4.27)	0.985	-0.17 (-1.54, 1.19)	0.805	0.951
DBP, mmHg	-0.02 (-3.08, 3.05)	0.991	-0.07 (-1.06, 0.93)	0.893	0.971
Cholesterol, mmol/L	-0.11 (-0.42, 0.20)	0.489	-0.04 (-0.13, 0.06)	0.421	0.650
HDL, mmol/L	-0.04 (-0.16, 0.09)	0.565	0.00 (-0.04, 0.04)	0.924	0.571
LDL, mmol/L	-0.05 (-0.34, 0.23)	0.710	-0.03 (-0.11, 0.05)	0.501	0.858
Triglycerides, mmol/L$^¥$	0.98 (0.83, 1.15)	0.799	0.98 (0.93, 1.02)	0.259	0.957
Glucose, mmol/L$^¥$	1.04 (1.00, 1.09)	0.058	1.01 (1.00, 1.02)	0.254	0.143
Insulin, mg/dL$^¥$	1.02 (0.78, 1.34)	0.863	1.02 (0.94, 1.11)	0.580	1.000
CRP, mg/l$^¥$	1.00 (0.60, 1.67)	0.993	1.16 (0.98, 1.39)	0.089	0.593

p* p-value for the difference between estimates for abuse <11 years and abuse 11-17 years.
Adjusted for age, sex, ethnicity, maternal education, paternal education, parental social class, and depression
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S11. Adjusted association (including depression) between abuse in childhood and cardiometabolic health outcomes at age 25 by age at exposure (N = 3,223)

Type of abuse/ Outcome	Abuse < 11 years β (95% CI)	p	Abuse 11-17 years β (95% CI)	p	p*
Physical abuse					
BMI, kg/m^2	1.11 (0.23, 1.98)	0.013	4.07 (1.25, 6.90)	0.005	0.051
Heart rate, bpm	0.97 (-1.43, 3.37)	0.423	9.31 (3.04, 15.59)	0.004	0.006
SBP, mmHg	-0.01 (-1.94, 1.93)	0.994	2.01 (-4.21, 8.22)	0.523	0.498
DBP, mmHg	0.93 (-0.52, 2.38)	0.206	3.91 (-1.17, 9.00)	0.129	0.232
Cholesterol, mmol/L	-0.10 (-0.27, 0.06)	0.216	-0.22 (-0.74, 0.30)	0.401	0.664
HDL, mmol/L	-0.07 (-0.15, 0.01)	0.106	-0.26 (-0.55, 0.03)	0.076	0.171
LDL, mmol/L	-0.05 (-0.18, 0.08)	0.437	0.05 (-0.37, 0.47)	0.815	0.659
Triglycerides, mmol/L$^¥$	1.01 (0.93, 1.11)	0.783	0.88 (0.69, 1.13)	0.326	0.271
Glucose, mmol/L$^¥$	1.01 (0.99, 1.03)	0.329	1.06 (0.99, 1.13)	0.105	0.188
Insulin, mg/dL$^¥$	1.23 (1.09, 1.38)	0.001	1.71 (1.12, 2.61)	0.015	0.122
CRP, mg/l$^¥$	1.21 (0.95, 1.54)	0.116	1.97 (0.86, 4.52)	0.108	0.301
Sexual abuse					
BMI, kg/m^2	0.83 (-0.11, 1.76)	0.084	0.68 (-0.08, 1.43)	0.079	0.822
Heart rate, bpm	0.82 (-1.76, 3.40)	0.529	1.38 (-0.44, 3.20)	0.136	0.717
SBP, mmHg	0.88 (-1.04, 2.79)	0.369	0.30 (-1.30, 1.90)	0.711	0.595
DBP, mmHg	1.15 (-0.40, 2.69)	0.145	0.24 (-1.07, 1.55)	0.715	0.361
Cholesterol, mmol/L	-0.09 (-0.26, 0.09)	0.322	-0.12 (-0.27, 0.03)	0.131	0.753
HDL, mmol/L	-0.08 (-0.17, 0.02)	0.103	-0.02 (-0.11, 0.06)	0.563	0.279
LDL, mmol/L	0.01 (-0.14, 0.16)	0.873	-0.1 (-0.23, 0.03)	0.141	0.205
Triglycerides, mmol/L$^¥$	0.98 (0.90, 1.07)	0.613	1.04 (0.96, 1.13)	0.285	0.188
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.687	1.00 (0.98, 1.01)	0.696	0.946
Insulin, mg/dL$^¥$	1.12 (0.98, 1.28)	0.086	1.10 (0.99, 1.21)	0.073	0.763
CRP, mg/l$^¥$	1.14 (0.87, 1.50)	0.334	1.06 (0.87, 1.30)	0.552	0.653
Psychological abuse					
BMI, kg/m^2	1.27 (-0.76, 3.31)	0.220	0.59 (0.02, 1.16)	0.042	0.537
Heart rate, bpm	3.15 (-1.57, 7.88)	0.189	0.31 (-1.18, 1.80)	0.678	0.251
SBP, mmHg	1.23 (-2.80, 5.25)	0.549	0.01 (-1.18, 1.21)	0.981	0.548
DBP, mmHg	0.99 (-2.28, 4.25)	0.553	0.22 (-0.69, 1.14)	0.631	0.675
Cholesterol, mmol/L	-0.13 (-0.50, 0.25)	0.509	-0.04 (-0.15, 0.07)	0.453	0.665
HDL, mmol/L	-0.17 (-0.36, 0.02)	0.085	-0.03 (-0.09, 0.02)	0.215	0.152
LDL, mmol/L	0.02 (-0.34, 0.39)	0.893	-0.05 (-0.15, 0.04)	0.246	0.678
Triglycerides, mmol/L$^¥$	1.04 (0.85, 1.26)	0.707	1.02 (0.96, 1.08)	0.613	0.832
Glucose, mmol/L$^¥$	1.06 (1.01, 1.11)	0.019	1.01 (1.00, 1.03)	0.146	0.054
Insulin, mg/dL$^¥$	1.47 (1.12, 1.92)	0.006	1.07 (0.98, 1.17)	0.131	0.014
CRP, mg/l$^¥$	1.03 (0.56, 1.90)	0.920	0.90 (0.77, 1.05)	0.176	0.665

p* p-value for the difference between estimates for abuse <11 years and abuse 11-17 years.
Adjusted for age, sex, ethnicity, maternal education, paternal education, parental social class, and depression
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S12. Adjusted association between child abuse in 3 frequency categories and cardiometabolic outcomes at 18 years (N = 3,223)

	Rarely or sometimes vs. never		Often or very often vs. never	
	β (95% CI)	p-value	β (95% CI)	p-value
Physical abuse				
BMI, kg/m^2	0.22 (-0.09, 0.53)	0.168	1.35 (0.62, 2.08)	<0.001
Heart rate, bpm	0.25 (-0.69, 1.20)	0.599	1.28 (-1.06, 3.62)	0.284
SBP, mmHg	0.60 (-0.28, 1.49)	0.179	1.23 (-0.79, 3.25)	0.232
DBP, mmHg	-0.23 (-0.89, 0.42)	0.482	1.38 (-0.39, 3.15)	0.125
Cholesterol, mmol/L	0.02 (-0.04, 0.09)	0.428	-0.08 (-0.23, 0.06)	0.255
HDL, mmol/L	0.00 (-0.02, 0.03)	0.788	-0.06 (-0.13, 0.01)	0.082
LDL, mmol/L	0.03 (-0.03, 0.09)	0.293	-0.01 (-0.14, 0.12)	0.909
Triglycerides, mmol/L$^{¥}$	0.96 (0.93, 1.00)	0.044	0.93 (0.86, 1.01)	0.072
Glucose, mmol/L$^{¥}$	1.00 (0.99, 1.01)	0.895	1.00 (0.97, 1.02)	0.727
Insulin, mg/dL$^{¥}$	0.98 (0.93, 1.03)	0.368	0.89 (0.79, 1.00)	0.054
CRP, mg/l$^{¥}$	0.99 (0.88, 1.11)	0.851	1.28 (0.97, 1.69)	0.081
Sexual abuse				
BMI, kg/m^2	-0.11 (-0.82, 0.60)	0.759	1.10 (0.27, 1.94)	0.010
Heart rate, bpm	1.28 (-0.93, 3.49)	0.257	2.30 (-0.10, 4.71)	0.061
SBP, mmHg	0.96 (-1.06, 2.98)	0.351	-0.11 (-2.53, 2.31)	0.929
DBP, mmHg	0.70 (-0.82, 2.21)	0.366	0.77 (-0.89, 2.42)	0.363
Cholesterol, mmol/L	-0.01 (-0.15, 0.13)	0.864	0.07 (-0.11, 0.24)	0.450
HDL, mmol/L	-0.01 (-0.07, 0.04)	0.644	0.02 (-0.05, 0.09)	0.569
LDL, mmol/L	0.01 (-0.12, 0.14)	0.858	0.04 (-0.11, 0.19)	0.567
Triglycerides, mmol/L$^{¥}$	0.96 (0.89, 1.04)	0.329	1.00 (0.90, 1.11)	1.000
Glucose, mmol/L$^{¥}$	0.99 (0.97, 1.01)	0.167	1.00 (0.97, 1.02)	0.930
Insulin, mg/dL$^{¥}$	0.92 (0.82, 1.03)	0.138	0.99 (0.85, 1.16)	0.927
CRP, mg/l$^{¥}$	0.97 (0.74, 1.28)	0.831	1.10 (0.78, 1.55)	0.587
Psychological abuse				
BMI, kg/m^2	-0.15 (-0.58, 0.29)	0.510	0.21 (-0.38, 0.81)	0.488
Heart rate, bpm	-0.60 (-1.92, 0.71)	0.370	-0.24 (-2.04, 1.56)	0.794
SBP, mmHg	0.36 (-0.87, 1.58)	0.569	0.12 (-1.70, 1.94)	0.897
DBP, mmHg	0.64 (-0.32, 1.60)	0.188	0.48 (-0.81, 1.77)	0.467
Cholesterol, mmol/L	0.03 (-0.06, 0.12)	0.459	-0.01 (-0.15, 0.13)	0.881
HDL, mmol/L	-0.01 (-0.05, 0.03)	0.505	-0.01 (-0.06, 0.04)	0.634
LDL, mmol/L	0.02 (-0.06, 0.11)	0.585	-0.01 (-0.13, 0.12)	0.884
Triglycerides, mmol/L$^{¥}$	1.02 (0.97, 1.08)	0.393	0.99 (0.93, 1.06)	0.863
Glucose, mmol/L$^{¥}$	1.01 (1.00, 1.02)	0.117	1.01 (1.00, 1.03)	0.067
Insulin, mg/dL$^{¥}$	1.00 (0.93, 1.08)	0.952	1.02 (0.91, 1.15)	0.688
CRP, mg/l$^{¥}$	0.96 (0.81, 1.13)	0.611	1.11 (0.89, 1.39)	0.342

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure; HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^{¥}$ these results should be interpreted as percent change

Table S13. Adjusted association between score of child abuse and cardiometabolic outcomes at 18 and 25 years in males and females (N = 3,223)

	Males				Females				p-value for sex interaction
	1 type of abuse	2 types of abuse	3 types of abuse	p-value	1 type of abuse	2 types of abuse	3 types of abuse	p-value	
18-year outcomes									
BMI, kg/m^2	0.27	2.12	4.39		0.34	0.46	2.20		
	(-0.50, 1.04)	(0.89, 3.36)	(-2.80, 11.58)	0.002	(-0.16, 0.84)	(-0.53, 1.45)	(0.50, 3.91)	0.012	0.158
Heart rate, bpm	-0.13	5.50	2.12		0.48	-0.45	5.07		
	(-2.92, 2.65)	(1.27, 9.73)	(-0.22, 4.46)	0.066	(-0.94, 1.90)	(-3.32, 2.42)	(0.11, 10.02)	0.235	0.179
SBP, mmHg	0.55	0.95	0.88		0.07	-0.61	0.62		
	(-2.39, 3.49)	(-3.36, 5.26)	(-31.87, 33.63)	0.590	(-1.20, 1.34)	(-3.57, 2.35)	(-3.73, 4.97)	0.938	0.451
DBP, mmHg	0.12	2.00	-1.06		0.25	0.07	1.38		
	(-1.79, 2.04)	(-0.90, 4.90)	(-24.01, 21.89)	0.326	(-0.71, 1.21)	(-2.12, 2.26)	(-1.79, 4.54)	0.495	0.530
Cholesterol, mmol/L	0.04	-0.02	0.17		-0.02	-0.09	-0.11		
	(-0.10, 0.18)	(-0.24, 0.21)	(-1.46, 1.80)	0.784	(-0.13, 0.09)	(-0.30, 0.12)	(-0.42, 0.19)	0.303	0.461
HDL, mmol/L	-0.03	-0.12	-0.21		-0.01	0.02	-0.05		
	(-0.09, 0.04)	(-0.22, -0.02)	(-0.88, 0.47)	0.029	(-0.05, 0.03)	(-0.07, 0.10)	(-0.18, 0.09)	0.823	0.113
LDL, mmol/L	0.09	0.06	0.43		-0.01	-0.10	-0.04		
	(-0.03, 0.22)	(-0.14, 0.26)	(-1.11, 1.98)	0.155	(-0.10, 0.08)	(-0.28, 0.09)	(-0.32, 0.25)	0.440	0.145
Triglycerides, mmol/L[¥]	0.95	1.01	0.94		0.98	0.96	0.93		
	(0.86, 1.05)	(0.88, 1.15)	(0.30, 2.93)	0.547	(0.93, 1.04)	(0.87, 1.07)	(0.79, 1.09)	0.277	0.914
Glucose, mmol/L[¥]	1.00	1.01	0.95		1.00	1.00	1.01		
	(0.97, 1.03)	(0.97, 1.05)	(0.71, 1.28)	0.977	(0.99, 1.01)	(0.98, 1.02)	(0.97, 1.05)	0.923	0.910
Insulin, mg/dL[¥]	0.97	1.00	1.17		1.00	1.00	0.95		
	(0.84, 1.13)	(0.82, 1.23)	(0.29, 4.78)	0.864	(0.93, 1.07)	(0.86, 1.17)	(0.75, 1.21)	0.834	0.799
CRP, mg/l [¥]	1.11	1.44	2.38		1.04	1.19	1.46		
	(0.81, 1.51)	(0.95, 2.19)	(0.06, 97.82)	0.082	(0.89, 1.23)	(0.81, 1.74)	(0.76, 2.80)	0.200	0.500
25-year outcomes									
BMI, kg/m^2	0.27	2.70	3.46		0.62	0.95	2.66		
	(-0.61, 1.16)	(1.15, 4.24)	(-5.18, 12.09)	0.003	(0.01, 1.22)	(-0.26, 2.15)	(0.56, 4.76)	0.001	0.502
Heart rate, bpm	0.28	4.77	1.40		0.47	-0.31	4.49		
	(-2.72, 3.28)	(0.59, 8.96)	(-31.98, 34.78)	0.105	(-0.88, 1.82)	(-3.16, 2.55)	(-0.49, 9.47)	0.274	0.277
SBP, mmHg	0.00	-1.37	8.61	0.690	0.22	0.74	0.13	0.529	0.398

				p				p	p
	(-2.36, 2.35)	(-5.21, 2.48)	(-12.81, 30.02)		(-0.98, 1.42)	(-1.44, 2.92)	(-4.02, 4.27)		
DBP, mmHg	-0.07	1.99	1.69		0.50	1.02	1.45		
	(-1.95, 1.81)	(-0.93, 4.90)	(-14.65, 18.04)	0.326	(-0.44, 1.44)	(-0.71, 2.75)	(-1.96, 4.86)	0.094	0.958
Cholesterol, mmol/L	0.07	-0.09	0.46		-0.11	-0.10	-0.46		
	(-0.12, 0.26)	(-0.40, 0.22)	(-1.13, 2.04)	0.893	(-0.22, 0.01)	(-0.32, 0.11)	(-0.82, -0.10)	0.006	0.251
HDL, mmol/L	-0.03	-0.19	-0.26		-0.03	-0.06	-0.11		
	(-0.10, 0.05)	(-0.32, -0.05)	(-0.95, 0.42)	0.012	(-0.08, 0.02)	(-0.17, 0.05)	(-0.31, 0.08)	0.094	0.360
LDL, mmol/L	0.06	0.01	0.41		-0.08	-0.10	-0.25		
	(-0.11, 0.23)	(-0.27, 0.29)	(-1.04, 1.87)	0.602	(-0.18, 0.01)	(-0.28, 0.08)	(-0.55, 0.06)	0.023	0.230
Triglycerides, mmol/L$^{¥}$	1.04	1.20	2.01		1.01	0.99	0.91		
	(0.93, 1.15)	(0.99, 1.46)	(0.80, 5.06)	0.044	(0.96, 1.07)	(0.89, 1.09)	(0.77, 1.08)	0.708	0.071
Glucose, mmol/L$^{¥}$	1.01	1.02	0.98		1.00	1.01	1.03		
	(0.99, 1.03)	(0.98, 1.06)	(0.80, 1.20)	0.209	(0.98, 1.01)	(0.98, 1.03)	(0.99, 1.08)	0.456	0.351
Insulin, mg/dL$^{¥}$	1.00	1.49	0.97		1.07	1.13	1.50		
	(0.86, 1.17)	(1.13, 1.97)	(0.27, 3.55)	0.025	(0.99, 1.16)	(0.98, 1.31)	(1.17, 1.93)	0.001	0.616
CRP, mg/l$^{¥}$	1.24	1.38	0.53		0.91	0.91	1.24		
	(0.93, 1.67)	(0.90, 2.10)	(0.06, 4.97)	0.044	(0.76, 1.10)	(0.67, 1.24)	(0.70, 2.19)	0.563	0.021

p-value corresponds to p-value for linear trend

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class

BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein

$^{¥}$ these results should be interpreted as percent change

The reference category corresponds to 0 (no experience of abuse).

Table S14. Adjusted association between child abuse in 3 frequency categories and cardiometabolic outcomes at 25 years (N = 3,223)

	Rarely or sometimes vs. never		Often or very often vs. never	
	β (95% CI)	p-value	β (95% CI)	p-value
Physical abuse				
BMI, kg/m^2	0.10 (-0.30, 0.50)	0.635	1.22 (0.32, 2.12)	0.008
Heart rate, bpm	0.20 (-0.71, 1.11)	0.668	1.15 (-1.30, 3.61)	0.353
SBP, mmHg	0.48 (-0.31, 1.28)	0.233	0.26 (-1.67, 2.19)	0.790
DBP, mmHg	0.16 (-0.49, 0.80)	0.635	1.04 (-0.44, 2.52)	0.168
Cholesterol, mmol/L	0.00 (-0.07, 0.08)	0.936	-0.12 (-0.29, 0.05)	0.174
HDL, mmol/L	-0.02 (-0.05, 0.02)	0.303	-0.08 (-0.17, 0.00)	0.063
LDL, mmol/L	0.00 (-0.07, 0.07)	0.986	-0.06 (-0.20, 0.08)	0.414
Triglycerides, mmol/L$^¥$	1.01 (0.97, 1.05)	0.713	1.01 (0.92, 1.11)	0.780
Glucose, mmol/L$^¥$	1.01 (1.00, 1.01)	0.182	1.01 (0.99, 1.04)	0.210
Insulin, mg/dL$^¥$	1.00 (0.94, 1.05)	0.901	1.23 (1.09, 1.38)	0.001
CRP, mg/l$^¥$	0.94 (0.84, 1.06)	0.315	1.18 (0.92, 1.53)	0.188
Sexual abuse				
BMI, kg/m^2	-0.12 (-1.01, 0.76)	0.785	1.56 (0.63, 2.50)	0.001
Heart rate, bpm	1.10 (-1.09, 3.29)	0.323	1.80 (-0.65, 4.25)	0.149
SBP, mmHg	0.50 (-1.30, 2.31)	0.584	0.50 (-1.43, 2.43)	0.610
DBP, mmHg	-0.03 (-1.54, 1.48)	0.970	1.56 (0.03, 3.08)	0.046
Cholesterol, mmol/L	-0.16 (-0.32, 0.00)	0.054	-0.08 (-0.26, 0.10)	0.366
HDL, mmol/L	0.02 (-0.07, 0.11)	0.641	-0.10 (-0.19, -0.02)	0.019
LDL, mmol/L	-0.13 (-0.27, 0.00)	0.056	0.00 (-0.18, 0.17)	0.972
Triglycerides, mmol/L$^¥$	0.99 (0.92, 1.07)	0.858	1.06 (0.96, 1.17)	0.239
Glucose, mmol/L$^¥$	1.00 (0.98, 1.02)	0.886	0.99 (0.97, 1.01)	0.390
Insulin, mg/dL$^¥$	1.11 (0.99, 1.25)	0.081	1.10 (0.96, 1.26)	0.151
CRP, mg/L$^¥$	1.06 (0.84, 1.34)	0.606	1.20 (0.92, 1.55)	0.176
Psychological abuse				
BMI, kg/m^2	-0.08 (-0.62, 0.47)	0.788	0.49 (-0.25, 1.24)	0.196
Heart rate, bpm	-0.51 (-1.74, 0.71)	0.411	-0.18 (-2.10, 1.75)	0.857
SBP, mmHg	0.58 (-0.59, 1.75)	0.331	0.45 (-1.10, 2.00)	0.571
DBP, mmHg	0.16 (-0.74, 1.05)	0.728	0.33 (-0.89, 1.54)	0.600
Cholesterol, mmol/L	-0.04 (-0.15, 0.07)	0.498	-0.08 (-0.23, 0.06)	0.261
HDL, mmol/L	-0.02 (-0.08, 0.03)	0.352	-0.05 (-0.12, 0.02)	0.135
LDL, mmol/L	-0.02 (-0.12, 0.09)	0.749	-0.08 (-0.20, 0.05)	0.243
Triglycerides, mmol/L$^¥$	1.02 (0.96, 1.07)	0.577	1.03 (0.96, 1.10)	0.453
Glucose, mmol/L$^¥$	1.01 (1.00, 1.02)	0.222	1.02 (1.00, 1.04)	0.063
Insulin, mg/dL$^¥$	1.03 (0.96, 1.11)	0.429	1.10 (0.99, 1.22)	0.077
CRP, mg/L$^¥$	1.05 (0.91, 1.23)	0.495	0.94 (0.76, 1.15)	0.532

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S15. Adjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years in complete cases

	18 years		25 years	
	β (95% CI)	P-value	β (95% CI)	p-value
Physical abuse				
BMI, kg/m^2	0.60 (-0.20, 1.41)	0.142	1.07 (0.03, 2.12)	0.045
Heart rate, bpm	0.52 (-2.02, 3.06)	0.689	0.74 (-2.09, 3.57)	0.608
SBP, mmHg	-0.47 (-2.94, 2.00)	0.709	0.05 (-2.02, 2.13)	0.959
DBP, mmHg	0.53 (-1.30, 2.37)	0.569	1.70 (0.06, 3.34)	0.042
Cholesterol, mmol/L	-0.16 (-0.32, 0.01)	0.071	-0.14 (-0.33, 0.04)	0.130
HDL, mmol/L	-0.07 (-0.14, 0.01)	0.069	-0.10 (-0.19, -0.01)	0.033
LDL, mmol/L	-0.06 (-0.21, 0.1)	0.451	-0.05 (-0.22, 0.12)	0.586
Triglycerides, mmol/L$^¥$	0.92 (0.84, 1.01)	0.097	1.01 (0.92, 1.11)	0.846
Glucose, mmol/L$^¥$	0.99 (0.97, 1.01)	0.425	1.00 (0.98, 1.03)	0.744
Insulin, mg/dL$^¥$	0.83 (0.73, 0.94)	0.005	1.16 (1.01, 1.33)	0.037
CRP, mg/L$^¥$	1.13 (0.85, 1.49)	0.395	1.11 (0.83, 1.47)	0.476
Sexual abuse				
BMI, kg/m^2	0.80 (0.19, 1.41)	0.010	1.06 (0.31, 1.82)	0.006
Heart rate, bpm	1.21 (-0.66, 3.08)	0.203	1.65 (-0.34, 3.65)	0.104
SBP, mmHg	0.29 (-1.53, 2.10)	0.759	0.95 (-0.58, 2.49)	0.222
DBP, mmHg	0.28 (-1.07, 1.63)	0.686	0.91 (-0.31, 2.12)	0.143
Cholesterol, mmol/L	0.02 (-0.12, 0.15)	0.795	-0.12 (-0.26, 0.02)	0.083
HDL, mmol/L	-0.01 (-0.07, 0.06)	0.867	-0.04 (-0.10, 0.03)	0.276
LDL, mmol/L	0.03 (-0.09, 0.16)	0.579	-0.09 (-0.21, 0.04)	0.177
Triglycerides, mmol/L$^¥$	0.95 (0.88, 1.02)	0.149	1.00 (0.93, 1.07)	0.998
Glucose, mmol/L$^¥$	0.99 (0.97, 1.00)	0.101	0.99 (0.98, 1.01)	0.497
Insulin, mg/dL$^¥$	0.89 (0.80, 0.99)	0.025	1.04 (0.94, 1.15)	0.428
CRP, mg/L$^¥$	1.14 (0.91, 1.42)	0.265	1.28 (1.04, 1.58)	0.022
Psychological abuse				
BMI, kg/m^2	0.53 (0.04, 1.02)	0.035	0.83 (0.18, 1.47)	0.012
Heart rate, bpm	-0.10 (-1.60, 1.40)	0.897	0.22 (-1.41, 1.86)	0.789
SBP, mmHg	-0.28 (-1.74, 1.17)	0.704	0.17 (-1.13, 1.46)	0.800
DBP, mmHg	-0.24 (-1.32, 0.85)	0.671	0.40 (-0.62, 1.43)	0.439
Cholesterol, mmol/L	-0.04 (-0.14, 0.07)	0.481	-0.03 (-0.15, 0.08)	0.569
HDL, mmol/L	-0.02 (-0.06, 0.03)	0.524	-0.03 (-0.09, 0.02)	0.255
LDL, mmol/L	-0.01 (-0.11, 0.08)	0.790	-0.01 (-0.12, 0.10)	0.871
Triglycerides, mmol/L$^¥$	0.97 (0.91, 1.02)	0.251	1.01 (0.95, 1.08)	0.642
Glucose, mmol/L$^¥$	1.00 (0.99, 1.02)	0.778	1.01 (1.00, 1.02)	0.164
Insulin, mg/dL$^¥$	1.03 (0.95, 1.11)	0.520	1.03 (0.95, 1.13)	0.452
CRP, mg/L$^¥$	1.13 (0.95, 1.35)	0.162	0.89 (0.74, 1.06)	0.191

Adjusted for age, sex, ethnicity, maternal education, paternal education, and parental social class.
BMI: body mass index, Cholesterol: total cholesterol, CRP: C-reactive protein, DBP: diastolic blood pressure;
HDL: high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol; SBP: systolic blood pressure
$^¥$ these results should be interpreted as percent change

Table S16. Adjusted association between child abuse and cardiometabolic outcomes at 18 and 25 years after correction for multiple testing (p<7.6 x 10^{-4})

Type of abuse	Timing of abuse	Outcome	β (95% CI)	p-value
Physical abuse	< 11 years	BMI at 18 years	1.32 (0.62, 2.02)	2.4 x 10^{-4}
Physical abuse	< 18 years	BMI at 18 years	1.35 (0.66, 2.05)	1.4 x 10^{-4}
Score of abuse	< 18 years	BMI at 18 years	0.50 (0.23, 0.76)	2.3 x 10^{-4}
Physical abuse	< 11 years	BMI at 18 years (females)	1.68 (0.77, 2.59)	3.2 x 10^{-4}
Physical abuse	< 18 years	BMI at 18 years (females)	1.66 (0.76, 2.57)	3.5 x 10^{-4}
Physical abuse	< 11 years	Insulin at 25 years	1.25 (1.12, 1.41)	1.3 x 10^{-4}
Physical abuse	< 18 years	Insulin at 25 years	1.26 (1.12, 1.41)	1.1 x 10^{-4}
Score of abuse	< 18 years	BMI at 25 years	0.71 (0.39, 1.03)	1.7 x 10^{-5}
Score of abuse	< 18 years	Insulin at 25 years	1.10 (1.05, 1.15)	5.9 x 10^{-5}
2 types of abuse	< 18 years	BMI at 25 years (males)	2.70 (1.15, 4.24)	6.6 x 10^{-4}
Physical abuse	< 18 years	Insulin at 25 years (females)	1.28 (1.12, 1.45)	2.6 x 10^{-4}
Physical abuse	< 11 years	Insulin at 25 years (females)	1.28 (1.12, 1.46)	2.3 x 10^{-4}

Figure S1. Co-occurrence of childhood abuse types (N = 3,223)

Physical abuse (5.1%)
0.3%
Sexual abuse (9.1%)
0.9%
2.4%
1.4%
Psychological abuse (12.5%)
No experience of child abuse: 79.2%

Physical abuse — — — Sexual abuse
— · — · — · Psychological abuse