O'Keeffe, L., Simpkin, A., Tilling, K., Anderson, E., Hughes, A. D., Lawlor, D., ... Howe, L. (2019). Data on trajectories of measures of cardiovascular health in the Avon Longitudinal Study of Parents and Children (ALSPAC). *Data in Brief*, *23*, [103687]. https://doi.org/10.1016/j.dib.2019.01.035

Data in Brief 23 (2019) 103687

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Data on trajectories of measures of cardiovascular health in the Avon Longitudinal Study of Parents and Children (ALSPAC)

Linda M. O'Keeffe [a,c,*], Andrew J. Simpkin [a,b,c], Kate Tilling [a,c], Emma L. Anderson [a,c], Alun D. Hughes [d,e], Debbie A. Lawlor [a,c], Abigail Fraser [a,c,1], Laura D. Howe [a,c,1]

[a] MRC Integrative Epidemiology Unit at the University of Bristol, UK
[b] Population Health Sciences, Bristol Medical School, University of Bristol, UK
[c] School of Mathematics, Statistics and Applied Mathematics, National University of Ireland, Galway, Ireland, UK
[d] Department of Population Science & Experimental Medicine, Institute of Cardiovascular Science, University College London, UK
[e] MRC Unit for Lifelong Health and Ageing at University College London, London, UK

ARTICLE INFO

Article history:
Received 19 October 2018
Received in revised form
9 January 2019
Accepted 18 January 2019

ABSTRACT

Cardiometabolic disease risk begins in early life and tracks through the life course. As described in "Sex-specific trajectories of measures of cardiovascular health during childhood and adolescence: a prospective cohort study" (O'Keeffe et al., 2018), we modelled sex-specific change in 11 key measures of cardiovascular health from birth/early childhood to age 18 years in a British birth cohort study, the Avon Longitudinal Study of Parents and Children (ALSPAC). In this article, we describe the data used in these analyses. Risk factors measured included BMI, fat and lean mass, blood pressure and blood-based biomarkers. Data are from several sources including cord blood at birth, clinic assessments, routine health records, questionnaires and nuclear magnetic resonance spectroscopy. Outcomes were measured over varying time spans from birth or mid-childhood to age 18 and with different numbers of repeated

DOI of original article: https://doi.org/10.1016/j.atherosclerosis.2018.09.030
* Corresponding author.
E-mail address: linda.okeeffe@bristol.ac.uk (L.M. O'Keeffe).
[1] Denotes equal contribution.

https://doi.org/10.1016/j.dib.2019.01.035

measures per outcome. Analyses were performed using fractional polynomial and linear spline multilevel models. Further information can be found in O'Keeffe et al. (2018).

Specifications table

Subject area	Epidemiology.
More specific subject area	Life course epidemiology.
Type of data	Tables and figures of analyzed data.
How data was acquired	Cord blood at birth, clinic assessments, routine health records, questionnaires and nuclear magnetic resonance (NMR) spectroscopy.
Data format	Analyzed
Experimental factors	Measures of cardiovascular health from birth or mid-childhood to 18 years in a UK prospective birth cohort study.
Experimental features	Participants were recruited at birth and followed up repeatedly over a period of 18 years.
Data source location	Bristol, UK.
Data accessibility	Data are with this article.
Related research article	O'Keeffe LM et al. Sex-specific trajectories of measures of cardiovascular health during childhood and adolescence: a prospective cohort study. Atherosclerosis. 2018; 278 (2018): 190–196.

Value of the data

- Repeated measures of 11 key measures of cardiovascular health have been analyzed and trajectories of these are available for use as exposures or outcomes to address other research questions.
- These trajectories may also be useful in comparative work with other cohorts to better understand change in measures of cardiovascular health during childhood and adolescence, their determinants and associations with outcomes in later life.
- Modelling strategies used for these data may also be useful for others who wish to examine change over time in risk factors, where multiple repeat measures are available.

1. Data

The data shared here are tables and figures of analyzed data from the Avon Longitudinal Study of Parents and Children (ALSPAC). The ALSPAC is a prospective birth cohort study in Southwest England and is described elsewhere in detail [1–3]. In summary, pregnant women resident in Avon, UK with expected dates of delivery 1st April 1991 to 31st December 1992 were invited to take part in the study. Of the 14,541 initial pregnancies, there was a total of 14,676 foetuses, resulting in 14,062 live births and 13,988 children who were alive at 1 year of age. Ethical approval for the study was obtained from the ALSPAC Ethics and Law Committee and the Local Research Ethics Committees. Data was available for 11 measures of cardiovascular health from birth or mid-childhood to 18 years. Data on the number, timing and sources of measures are detailed elsewhere [1–7]. A comprehensive profiling of offspring circulating lipids, lipoproteins, and metabolites was done by a high-throughput nuclear magnetic resonance (NMR) metabolomics platform, providing a snapshot of offspring serum metabolome [8,9]. Non-fasting glucose at age seven from NMR was included in these analyses. Data were analyzed by sex from birth to 18 years. Model fit statistics for analyses performed, characteristics

of participants included and excluded from analyses, mean sex-specific trajectories of each measure of cardiovascular health and results from sensitivity analyses are included in this paper.

2. Experimental design, materials and methods

2.1. Study population

The ALSPAC has been described elsewhere in detail [1–3]. The study website contains details of all the data that is available through a fully searchable data dictionary http://www.bristol.ac.uk/alspac/researchers/our-data/ [4].

2.2. Methods and statistical analysis

Two approaches, linear splines and fractional polynomials multilevel models were used in the modelling of trajectories of measures of cardiovascular health [1,10–13].

We derived appropriate powers of height adjustment for DXA-determined fat and lean mass which were age and sex-specific and included these in multilevel models (Table 1). Observed and predicted measurements for models are shown in Tables 2–12. We examined the characteristics of mothers of participants included in the analysis of insulin (outcome measured on the fewest participants and with fewest repeated measures) compared with mothers of participants excluded from our analysis (Table 13). The mean sex-specific trajectories of measures of cardiovascular health are shown in Tables 14–17. We also regressed the observed risk factor at the first occasion of measurement and last occasion of measurement (18 years) on sex to examine whether sex differences estimated from the multilevel model at these ages were comparable to the observed data (Table 18). We restricted the sample for each risk factor to those with at least one measure before and one after the 11-year clinic, to examine whether results from the main analysis were driven by participants with only a single pre- or post-puberty measure (Figs. 1–4). We repeated analyses of BMI restricted to participants with more than six measures to examine if results were driven by participants with a greater number of measures (Fig. 5). We also repeated analyses excluding the observations of participants at the 15- and 18-year clinics who reported eating in the four hours preceding these clinics to examine if our results were altered by the inclusion of some non-fasted bloods (Figs. 6 and 7). Glucose at age 15 and 18 from the NMR platform was compared with glucose from standard clinical chemistry assays at these ages to examine the comparability of NMR and clinical chemistry measures (Table 19).

Table 1
Age and sex-specific powers of height included in multilevel models of fat mass and lean mass

	Fat mass	Lean mass
Females		
Overall		
Age 9	Height^5.2	Height^2.3
Age 11	Height^4.2	Height^2.6
Age 13	Height^3	Height^2
Age 15	Height^2.4	Height^1.8
Age 18	Height^1.8	Height^1.8
Males		
Overall		
Age 9	Height^6.6	Height^2.1
Age 11	Height^5.4	Height^2.4
Age 13	Height^2	Height^2.8
Age 15	Height^2.4	Height^2.4
Age 18	Height^1.9	Height^1.8

Table 2
Model details for log BMI trajectories by sex

	No of contributing individuals		**Assessment of model fit**			
	Total number of observations	Number of individuals with 1 measure	Mean observed BMI, log BMI in kg/m^2 (SD)	Mean predicted BMI, log BMI in kg/m^2 (SD)	Mean difference (observed – predicted), log BMI in kg/m^2	95% level of agreement between observed and predicted, log BMI in kg/m^2
Females						
Overall	56,103	6815				
1–3 years	9995	5288	2.82 (0.09)	2.81 (0.07)	0.01	-0.10 to 0.11
3–7 years	12,435	5631	2.77 (0.11)	2.77 (0.08)	-0.002	-0.15 to 0.15
7–9 years	7114	4209	2.81 (0.13)	2.82 (0.13)	-0.01	-0.08 to 0.06
9–11 years	8170	4184	2.88 (0.16)	2.88 (0.15)	-0.001	-0.08 to 0.08
11–13 years	6681	3852	2.96 (0.17)	2.95 (0.16)	0.01	-0.07 to 0.10
13–15 years	6036	3742	3.00 (0.16)	3.00 (0.16)	0.01	-0.11 to 0.12
15–18 years	5672	3474	3.10 (0.17)	3.11 (0.16)	-0.01	-0.11 to 0.08
Males						
Overall	56,665	7170				
1–3 years	10,884	5629	2.84 (0.09)	2.83 (0.07)	0.01	-0.10 to 0.11
3–7 years	13,470	5987	2.78 (0.10)	2.78 (0.07)	-0.004	-0.14 to 0.14
7–9 years	7247	4342	2.79 (0.12)	2.80 (0.11)	-0.01	-0.08 to 0.06
9–11 years	7986	4120	2.86 (0.15)	2.86 (0.14)	0.003	-0.07 to 0.08
11–13 years	6398	3756	2.93 (0.17)	2.92 (0.15)	0.01	-0.06 to 0.09
13–15 years	5895	3686	2.97 (0.16)	2.97 (0.16)	0.001	-0.11 to 0.11
15–18 years	4785	2991	3.07 (0.16)	3.08 (0.16)	-0.01	-0.10 to 0.07

Table 3
Model details for log fat mass trajectories by sex

	No of contributing individuals		**Assessment of model fit**			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), log fat mass in kg	Mean predicted (SD), log fat mass in kg	Mean difference (observed – predicted), log fat mass in kg	95% level of agreement between observed and predicted, ln log fat mass in kg
Females						
Overall	15,619	4461				
9 years	3664	3664	2.14 (0.51)	2.15 (0.48)	-0.003	-0.15 to 0.14
9–13 years	7204	4135	2.29 (0.52)	2.29 (0.50)	0.002	-0.17 to 0.17
13–15 years	3085	3056	2.69 (0.44)	2.70 (0.42)	-0.01	-0.21 to 0.19
15–18 years	5330	3305	2.92 (0.41)	2.92 (0.38)	0.002	-0.15 to 0.16
Males						
Overall	14,524	4341				
9 years	3577	3577	1.81 (0.60)	1.82 (0.55)	-0.01	-0.21 to 0.19
9–13 years	7005	4055	1.98 (0.62)	1.97 (0.58)	0.01	-0.22 to 0.24
13–15 years	2964	2949	2.20 (0.62)	2.23 (0.58)	-0.03	-0.33 to 0.27
15–18 years	4555	2870	2.31 (0.64)	2.31 (0.60)	0.01	-0.22 to 0.23

Table 4
Model details for lean mass trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), kg	Mean predicted (SD), kg	Mean difference (observed – predicted), kg	95% level of agreement between observed and predicted, kg
Females						
Overall	15,680	4474				
9 years	3675	3675	23.66 (3.19)	23.65 (3.03)	0.01	-2.12 to 2.15
9–13 years	7228	4148	26.46 (4.82)	26.49 (4.55)	-0.03	-2.16 to 2.10
13–15 years	3097	3068	35.21 (4.04)	35.08 (3.91)	0.13	-2.11 to 2.36
15–18 years	5355	3319	37.52 (4.17)	37.56 (3.86)	-0.03	-1.75 to 1.68
Males						
Overall	14,540	4344				
9 years	3586	3586	25.51 (2.98)	25.55 (2.43)	-0.04	-3.02 to 2.94
9–13 years	7010	4057	27.78 (4.31)	27.75 (4.02)	0.03	-2.71 to 2.77
13–15 years	2964	2949	40.90 (7.16)	41.04 (6.28)	-0.14	-3.57 to 3.28
15–18 years	4564	2874	52.25 (7.09)	52.20 (6.88)	0.05	-2.18 to 2.28

Table 5
Model details for SBP trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), mmHg	Mean predicted (SD), mmHg	Mean difference (observed – predicted), mmHg	95% level of agreement between observed and predicted, mmHg
Females						
Overall	23,731	4957				
7 years	3967	3967	99.06 (9.27)	98.93 (5.49)	0.14	-10.91 to 11.19
7–12 years	14,696	4706	102.96 (9.73)	103.10 (6.30)	-0.14	-12.01 to 11.73
12–16 years	6228	3671	114.67 (10.95)	114.17 (7.72)	0.50	-11.16 to 12.17
16–18 years	2807	2702	112.59 (8.53)	112.95 (5.46)	-0.36	-12.75 to 12.03
Males						
Overall	22,590	4965				
7 years	4090	4090	98.83 (9.06)	98.75 (5.33)	0.08	-10.49 to 10.65
7–12 years	14,497	4769	102.35 (9.34)	102.46 (6.06)	-0.11	-11.50 to 11.28
12–16 years	5894	3532	116.82 (12.36)	116.42 (9.59)	0.40	-11.42 to 12.21
16–18 years	2199	2139	122.27 (9.42)	122.59 (5.81)	-0.32	-12.21 to 11.58

SBP; systolic blood pressure.

Table 6
Model details for DBP trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), mmHg	Mean predicted (SD), mmHg	Mean difference (observed – predicted), mmHg	95% level of agreement between observed and predicted, mmHg
Females						
Overall	23,731	4957				
7 years	3967	3967	56.86 (6.57)	57.07 (3.27)	-0.21	-9.04 to 8.63
7–12 years	14,696	4706	58.51 (6.99)	58.10 (3.58)	0.41	-9.81 to 10.64
12–16 years	6228	3671	61.00 (9.23)	61.84 (4.69)	-0.84	-12.43 to 10.75
16–18 years	2807	2702	64.87 (5.98)	65.17 (3.43)	-0.29	-13.17 to 12.58

Table 6 (*continued*)

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), mmHg	Mean predicted (SD), mmHg	Mean difference (observed – predicted), mmHg	95% level of agreement between observed and predicted, mmHg
Males						
Overall	22,589	4965				
7 years	4090	4090	56.09 (6.66)	56.32 (3.46)	-0.24	-8.87 to 8.40
7–12 years	14,497	4769	57.68 (6.89)	57.27 (3.62)	0.41	-9.45 to 10.27
12–16 years	5894	3532	61.16 (9.91)	62.05 (5.49)	-0.89	-12.36 to 10.58
16–18 years	2199	2139	63.47 (6.19)	63.85 (3.66)	-0.37	-12.78 to 12.03

DBP; diastolic blood pressure.

Table 7
Model details for pulse rate trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), bpm	Mean predicted (SD), bpm	Mean difference (observed – predicted), bpm	95% level of agreement between observed and predicted, bpm
Females						
Overall	23,731	4957				
7 years	3967	3967	84.39 (10.69)	84.64 (5.97)	-0.25	-13.65 to 13.16
7–12 years	14,696	4706	79.49 (11.37)	79.28 (7.26)	0.21	-13.94 to 14.36
12–16 years	6228	3671	75.99 (11.06)	76.37 (6.34)	-0.37	-14.66 to 13.91
16–18 years	2807	2702	67.96 (10.07)	68.24 (5.97)	-0.29	-14.98 to 14.41
Males						
Overall	22,590	4965				
7 years	4090	4090	81.78 (10.59)	81.61 (6.04)	0.18	-12.38 to 12.73
7–12 years	14,497	4769	75.79 (11.49)	75.84 (7.73)	-0.05	-13.41 to 13.31
12–16 years	5894	3532	72.00 (11.11)	71.78 (6.74)	0.22	-13.20 to 13.64
16–18 years	2199	2139	63.12 (9.60)	63.37 (5.56)	-0.25	-14.55 to 14.05

bpm, beats per minute.

Table 8
Model details for glucose trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed, mmol/l (SD)	Mean predicted, mmol/l (SD)	Mean difference (observed – predicted), mmol/l	95% level of agreement between observed and predicted, mmol/l
Females						
Overall	6519	3594				
7 years	2646	2646	4.14 (0.50)	4.17 (0.24)	-0.03	-0.56 to 0.49
7–15 years	3070	2751	4.24 (0.54)	4.23 (0.28)	0.01	-0.56 to 0.58
15–18 years	3449	2347	5.02 (0.37)	5.03 (0.14)	-0.01	-0.60 to 0.58
Males						
Overall	6533	3661				
7 years	2834	2834	4.22 (0.50)	4.26 (0.21)	-0.04	-0.63 to 0.56
7–15 years	3290	2941	4.33 (0.55)	4.32 (0.26)	0.01	-0.62 to 0.64
15–18 years	3243	2191	5.22 (0.40)	5.23 (0.13)	-0.01	-0.64 to 0.62

Table 9
Model details for log insulin trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), log insulin in mu/l	Mean predicted (SD), log insulin in mu/l	Mean difference (observed – predicted), log insulin in mu/l	95% level of agreement between observed and predicted, ln log insulin in mu/l
Females						
Overall	901	331				
Birth	135	135	1.10 (0.49)	1.10 (0.26)	-0.000000001	-0.46 to 0.46
0–9 years	135	135	1.10 (0.49)	1.10 (0.26)	-0.000000001	-0.46 to 0.46
9–15 years	271	270	1.66 (0.61)	1.66 (0.43)	-0.002	-0.37 to 0.36
15–18 years	495	329	2.17 (0.48)	2.16 (0.27)	0.001	-0.50 to 0.51
Males						
Overall	930	331				
Birth	127	127	1.03 (0.52)	1.03 (0.16)	-0.0000000002	-0.73 to 0.73
9 years	127	127	1.03 (0.52)	1.03 (0.16)	-0.0000000002	-0.73 to 0.73
9–15 years	284	283	1.51 (0.61)	1.51 (0.31)	-0.001	-0.64 to 0.63
15–18 years	519	330	1.99 (0.55)	1.99 (0.26)	0.0003	-0.75 to 0.75

Table 10
Model details for log triglyceride trajectories by sex

	No of contributing individuals		Assessment of model fit			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), log triglyceride in mmol/l	Mean predicted (SD), log triglyceride in mmol/l	Mean difference (observed – predicted), log triglyceride in mmol/l	95% level of agreement between observed and predicted, log triglyceride in mmol/l
Females						
Overall	10,927	4992				
Birth	2358	2358	-0.69 (0.45)	-0.69 (0.23)	-0.004	-0.45 to 0.44
0–9 years	4915	4055	-0.34 (0.55)	-0.35 (0.39)	0.01	-0.50 to 0.52
9–18 years	6012	3333	-0.12 (0.40)	-0.11 (0.22)	-0.01	-0.53 to 0.52
Males						
Overall	10,999	5136				
Birth	2412	2412	-0.68 (0.45)	-0.68 (0.20)	-0.002	-0.49 to 0.49
0–9 years	5157	4294	-0.36 (0.53)	-0.37 (0.35)	0.003	-0.54 to 0.55
9–18 years	5842	3276	-0.16 (0.42)	-0.16 (0.22)	-0.003	-0.56 to 0.55

Table 11
Model details for non-HDL-c trajectories by sex

	No of contributing individuals		**Assessment of model fit**			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), mmol/l	Mean predicted (SD), mmol/l	Mean difference (observed – predicted), mmol/l	95% level of agreement between observed and predicted, mmol/l
Females						
Overall	10,891	4979				
Birth	2279	2279	1.25 (0.53)	1.28 (0.21)	-0.02	-0.65 to 0.60
0–9 years	4856	4031	2.17 (1.05)	2.12 (0.86)	0.06	-0.58 to 0.69
9–18 years	6035	3337	2.74 (0.68)	2.79 (0.52)	-0.04	-0.66 to 0.57
Males						
Overall	10,983	5119				
Birth	2341	2341	1.18 (0.52)	1.20 (0.26)	-0.02	-0.53 to 0.49
0–9 years	5096	4264	2.05 (0.98)	2.00 (0.81)	0.05	-0.51 to 0.60
9–18 years	5887	3294	2.55 (0.64)	2.59 (0.52)	-0.04	-0.58 to 0.51

HDL-c, high density lipoprotein cholesterol

Table 12
Model details for HDL-c trajectories by sex

	No of contributing individuals		**Assessment of model fit**			
	Total number of observations	Number of individuals with 1 measure	Mean observed (SD), mmol/l	Mean predicted (SD), mmol/l	Mean difference (observed – predicted), mmol/l	95% level of agreement between observed and predicted, mmol/l
Females						
Overall	10,939	4988				
Birth	2320	2320	0.55 (0.24)	0.55 (0.11)	-0.00000002	-0.27 to 0.27
0–7 years	2321	2321	0.55 (0.25)	0.55 (0.11)	0.00003	-0.27 to 0.27
7–18 years	8618	3957	1.40 (0.31)	1.40 (0.22)	-0.00001	-0.28 to 0.28
Males						
Overall	11,019	5127				
Birth	2380	2380	0.50 (0.23)	0.50 (0.12)	-0.000001	-0.23 to 0.23
0–7 years	2381	2381	0.50 (0.23)	0.50 (0.12)	0.00005	-0.23 to 0.23
7–18 years	8638	4014	1.38 (0.32)	1.38 (0.26)	-0.00001	-0.25 to 0.25

HDL-c, high density lipoprotein cholesterol

Table 13
Characteristics at birth of the mothers of children included in models of insulin (risk factor with least individuals and number of repeated measures)

	Participants included n= 662[a] n (%)	**Participants excluded n=19,388[b] n (%)**	***P* value for comparison [c]**
Sex of child			
Male	331(50.0)	9746(51.8)	0.355
Female	331(50.0)	9059(48.2)	
Maternal marital status			
Never married	74(11.4)	2525(19.6)	< 0.001
Widowed	< 0.8[d](< 5[d])	18(0.1)	
Divorced	19(2.9)	560(4.3)	
Separated	9(1.4)	210(1.6)	
1st Marriage	512(78.6)	8752(67.8)	
Marriage 2 or 3	37(5.7)	848(6.6)	
Household social class			
Professional	115(18.6)	1426(13.0)	< 0.001
Managerial & Technical	287(46.5)	4552(41.5)	
Non-Manual	141(22.9)	2807(25.6)	
Manual	51(8.3)	1513(13.8)	
Part Skilled & Unskilled	23(3.7)	670(6.1)	
Maternal education			
Less than O level	101(15.5)	3655(30.8)	< 0.001
O level	224(34.4)	4105(34.6)	
A level	199(30.6)	2605(22.0)	
Degree or above	127(19.5)	1483(12.5)	
Partners highest educational qualification			
Less than O level	138(21.7)	4016(35.3)	< 0.001
O level	140(22.0)	2416(21.2)	
A level	193(30.3)	2930(25.7)	
Degree or Above	166(26.1)	2018(17.7)	
Maternal smoking during pregnancy			
Yes	557(85.3)	9440(74.3)	< 0.001
No	96(14.7)	3271(25.7)	
	Mean (SD)	***Mean (SD)***	***P* value**
Child gestational age at birth	40(1.55)	38(5.62)	< 0.001

[a] Denominators for included participants in this table may be less than N included in full multilevel model due to missing data for these characteristics at baseline which were not required for our model (age, sex and at least one measure of risk factor before and after age 11 years were required for inclusion). [b] Denominator for participants excluded may also vary due to missing data on the characteristics included in the table.

[c] *P* value is for the difference in proportions for categorical variables from χ^2 test or difference in means for continuous variables from t tests between included and excluded participants. [d] May include zero.

Table 14
Mean sex-specific trajectories of anthropometric risk factors estimated from multilevel models

	Mean trajectory (95% CI) in females	**Mean trajectory (95% CI) in males**	**Mean difference in trajectory (95% CI) comparing females with males**	***P* value for difference between females and males**
Log BMI [a]				
Age 1 yr (log BMI, kg/m^2)	2.90 (2.89,2.90)	2.89 (2.89,2.90)	0.59% (-0.06,1.23)[b]	0.077
Age 3 yr (log BMI, kg/m^2)	2.75 (2.75,2.75)	2.77 (2.77,2.77)	-1.86% (-2.22, -1.49)[b]	< 0.001
Age 7 yr (log BMI, kg/m^2)	2.80 (2.80,2.80)	2.79 (2.79,2.79)	0.88% (0.46,1.31)[b]	< 0.001
Age 9 yr (log BMI, kg/m^2)	2.85 (2.85,2.85)	2.83 (2.83,2.83)	2.12% (1.61,2.65)[b]	< 0.001
Age 11 yr (log BMI, kg/m^2)	2.91 (2.91,2.91)	2.88 (2.88,2.88)	2.98% (2.38,3.58)[b]	< 0.001
Age 13 yr (log BMI, kg/m^2)	2.98 (2.97,2.98)	2.95 (2.94,2.95)	3.34% (2.69,3.98)[b]	< 0.001
Age 15 yr v kg/m^2)	3.06 (3.05,3.06)	3.02 (3.02,3.03)	3.14% (2.47,3.82)[b]	< 0.001
Age 18 yr (log BMI, kg/m^2)	3.14 (3.13,3.14)	3.11 (3.11,3.12)	2.35% (1.62,3.09[b]	< 0.001

Table 14 (*continued*)

	Mean trajectory (95% CI) in females	Mean trajectory (95% CI) in males	Mean difference in trajectory (95% CI) comparing females with males	*P* value for difference between females and males
Log height -adjusted fat mass				
Age 9 yr (log fat mass, kg)	2.01 (1.99,2.03)	1.77 (1.74,1.79)	27.3% (22.94,31.82)[b]	< 0.001
Change 9–13 yr (log fat mass, kg/yr)	0.16 (0.15,0.16)	0.13 (0.12,0.14)	3.02%/yr (1.93,4.12)[b]	< 0.001
Change 13–15 yr (log fat mass, kg/yr)	0.10 (0.09,0.11)	-0.06 (-0.07, -0.05)	17.85%/yr (16.56,19.16)[b]	< 0.001
Change 15–18 yr (log fat mass, kg/yr)	0.06 (0.05,0.06)	0.10 (0.09,0.10)	-3.71%/yr (-4.44, -2.98)[b]	< 0.001
Age 18 yr (log fat mass, kg)	3.01 (3.00,3.03)	2.44 (2.42,2.46)	77.8% (72.98,82.77)[b]	< 0.001
Height-adjusted lean mass				
Age 9 yr (kg)	20.78 (20.69,20.88)	23.97 (23.86,24.09)	-3.19 kg (-3.34, -3.04)	< 0.001
Change 9–13 yr (kg/yr)	3.25 (3.22,3.28)	2.32 (2.26,2.38)	0.93 kg/yr (0.86,1.00)	< 0.001
Change 13–15 yr (kg/yr)	1.52 (1.44,1.61)	7.62 (7.53,7.70)	-6.09 kg/yr (-6.21, -5.97)	< 0.001
Change 15–18 yr (kg/yr)	0.41 (0.37,0.44)	2.51 (2.44,2.59)	-2.11 kg/yr (-2.19, -2.02)	< 0.001
Age 18 yr (kg)	37.64 (37.50,37.77)	56.03 (55.80,56.26)	-18.39 kg (-18.66, -18.12)	< 0.001

[a] BMI is modelled using fractional polynomials. For ease of interpretation, the predicted log BMI for females and males is shown at each age rather than the coefficients for the fractional polynomial terms from the model.

[b] The difference between females and males for BMI and fat mass is back transformed from the log scale for ease of interpretation and is interpreted as the percentage difference in the mean level comparing females with males or percentage difference in change per year comparing females with males.

Table 15
Mean sex-specific trajectories of blood pressure and pulse rate estimated from multilevel models

	Mean trajectory (95% CI) in females	Mean trajectory (95% CI) in males	Mean difference in trajectory (95% CI) comparing females with males	*P* value for difference between females and males
SBP				
Age 7 yr (mmHg)	98.14 (97.84,98.43)	98.00 (97.72,98.28)	0.14 (-0.27,0.55)	0.497
Change 7–12 yr (mmHg/yr)	1.85 (1.78,1.92)	1.64 (1.57,1.70)	0.22 (0.12,0.32)	< 0.001
Change 12–16 yr (mmHg/yr)	3.82 (3.70,3.94)	5.78 (5.66,5.90)	-1.97 (-2.13,-1.80)	< 0.001
Change 16–18 yr (mmHg/yr)	-5.74 (-6.00,-5.49)	-3.82 (-4.09,-3.54)	-1.93 (-2.30,-1.56)	< 0.001
Age 18 yr (mmHg)	111.18 (110.86,111.51)	121.67 (121.27,122.07)	-10.48 (-11.00,-9.97)	< 0.001
DBP				
Age 7 yr (mmHg)	57.13 (56.92,57.34)	56.34 (56.13,56.54)	0.79 (0.50,1.09)	< 0.001
Change 7–12 yr (mmHg/yr)	0.09 (0.03,0.14)	0.14 (0.08,0.19)	-0.05 (-0.12,0.03)	0.247
Change 12–16 yr (mmHg/yr)	2.34 (2.24,2.44)	2.81 (2.70,2.92)	-0.47 (-0.62,-0.32)	< 0.001
Change 16–18 yr (mmHg/yr)	-1.01 (-1.21,-0.80)	-2.49 (-2.73,-2.25)	1.49 (1.17,1.81)	< 0.001
Age 18 yr (mmHg)	64.91 (64.67,65.16)	63.26 (62.98,63.55)	1.65 (1.27,2.02)	< 0.001
Pulse rate				
Age 7 yr (bpm)	85.77 (85.43,86.11)	82.71 (82.38,83.04)	3.06 (2.58,3.54)	< 0.001
Change 7–12 yr (bpm/yr)	-1.77 (-1.86,-1.69)	-1.89 (-1.97,-1.81)	0.11 (0.00,0.23)	0.053
Change 12–16 yr (bpm/yr)	-0.17 (-0.30,-0.05)	-0.76 (-0.89,-0.63)	0.59 (0.41,0.77)	< 0.001
Change 16–18 yr (bpm/yr)	-4.73 (-5.00,-4.46)	-4.08 (-4.36,-3.79)	-0.65 (-1.04,-0.27)	< 0.001
Age 18 yr (bpm)	66.75 (66.37,67.13)	62.07 (61.66,62.48)	4.68 (4.12,5.24)	< 0.001

bpm, beats per minute; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 16
Mean sex-specific trajectories of glucose and log insulin estimated from multilevel models

	Mean trajectory (95% CI) in females	Mean trajectory (95% CI) in males	Mean difference in trajectory (95% CI) comparing females with males	*P* value for difference between females and males
Glucose				
Age 7 yr (mmol/l)	4.11 (4.09,4.13)	4.18 (4.16,4.20)	-0.08 mmol/l (-0.10,-0.05)	< 0.001
Change 7–15 yr (mmol/l/yr)	0.13 (0.13,0.14)	0.15 (0.14,0.15)	-0.01 mmol/l/yr (-0.02,-0.01)	< 0.001
Change 15–18 yr (mmol/l/yr)	-0.09 (-0.10,-0.08)	-0.08 (-0.09,-0.07)	-0.02 mmol/l/yr (-0.03, 0.00)	0.023
Age 18 yr (mmol/l)	4.90 (4.88,4.92)	5.12 (5.10,5.14)	-0.22 mmol/l (-0.25, -0.19)	< 0.001
Log insulin				
Birth (log insulin, mu/l)	1.10 (1.01,1.18)	1.02 (0.93,1.11)	7.81% (-4.46,21.65)[a]	0.223
Change 0–9 yr (log insulin, mu/l /yr)	0.05 (0.04,0.06)	0.04 (0.03,0.06)	0.67%/yr (-1.19,2.56)[a]	0.486
Change 9–15 yr (log insulin, mu/l /yr)	0.14 (0.12,0.15)	0.14 (0.12,0.15)	0.11%/yr (-2.24,2.52)[a]	0.928
Change 15–18 yr (log insulin, mu/l /yr)	-0.13 (-0.16, -0.09)	-0.15 (-0.18, -0.11)	2.17%/yr (-2.52,7.08)[a]	0.371
Age 18 yr (log insulin, mu/l)	1.97 (1.91,2.05)	1.77 (1.69,1.84)	22.85% (10.76,36.35)[a]	0.000

[a] The difference between females and males is back transformed from the log scale for ease of interpretation and is interpreted as the percentage difference in the mean level comparing females with males or percentage difference in change per year comparing females with males.

Table 17
Mean sex-specific trajectories of log triglyceride and cholesterol estimated from multilevel models

	Mean trajectory (95% CI) in females	Mean trajectory (95% CI) in males	Mean difference in trajectory (95% CI) comparing females with males	*P* value for difference between females and males
Log triglyceride				
Birth (log triglyceride, mmol/l)	-0.69 (-0.70,-0.67)	-0.68 (-0.70,-0.66)	-0.70% (-3.17,1.84)[a]	0.586
Change 0–9 yr (log triglyceride, mmol/l/yr)	0.09 (0.08,0.09)	0.08 (0.08,0.08)	0.90%/yr (0.53,1.28)[a]	< 0.001
Change 9–18 yr (log triglyceride, mmol/l/yr)	-0.04 (-0.05,-0.04)	-0.04 (-0.04,-0.04)	-0.41%/yr (-0.72,-0.09)[a]	0.012
Age 18 yr (log triglyceride, mmol/l)	-0.29 (-0.31,-0.28)	-0.33 (-0.35,-0.31)	3.80% (1.59,6.06)[a]	0.001
HDL-c				
Birth (mmol/l)	0.55 (0.54,0.56)	0.50 (0.49,0.51)	0.05 mmol/l (0.03,0.06)	< 0.001
Change 0–7 yr (mmol/l/yr)	0.13 (0.13,0.13)	0.15 (0.15,0.15)	-0.02 mmol/l/yr (-0.02,-0.02)	< 0.001
Change 7–18 yr (mmol/l/yr)	-0.01 (-0.01,-0.01)	-0.04 (-0.04,-0.03)	0.02 mmol/l/yr (0.02,0.02)	< 0.001
Age 18 yr (mmol/l)	1.32 (1.31,1.33)	1.15 (1.14,1.16)	0.17 mmol/l (0.15,0.18)	< 0.001
Non-HDL-c				
Birth (mmol/l)	1.28 (1.26,1.30)	1.22 (1.19,1.24)	0.07 mmol/l (0.04,0.10)	< 0.001
Change 0–9 yr (mmol/l/yr)	0.21 (0.21,0.21)	0.19 (0.19,0.20)	0.02 mmol/l/yr (0.01,0.02)	< 0.001
Change 9–18 yr (mmol/l/yr)	-0.07 (-0.08,-0.07)	-0.07 (-0.08,-0.07)	0.00 mmol/l/yr (-0.01,0.00)	0.265
Age 18 yr (mmol/l)	2.49 (2.46,2.52)	2.30 (2.27,2.32)	0.19 mmol/l (0.16,0.23)	< 0.001

HDL-c, high density lipoprotein cholesterol

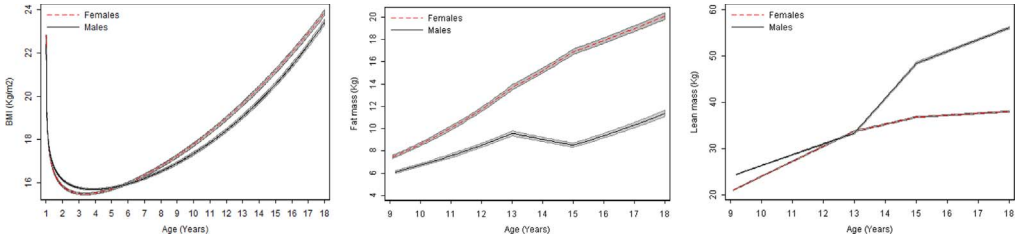
[a] The difference between females and males is back transformed from the log scale for ease of interpretation and is interpreted as the percentage difference in the mean level comparing females with males or percentage difference in change per year comparing females with males.

Tablee 18
Sex differences in risk factors at first and last available measure from linear regressions compared to differences predicted from multilevel models

	N participants in regression of risk factor on sex at each age	Difference in females compared with males from regression (95% CI)	Difference in females compared with males from multilevel model (95% CI)
Log BMI (kg/m^2)[a]			
Age 1	1060	-1.64(-2.60,-0.68)	0.59 (-0.05,1.24)
Age 18	995	2.31(0.03,4.59)	2.35 (1.62,3.09)
Log fat mass (kg)[a]			
Age 9	7241	39.53(35.98,43.08)	27.30 (22.94,31.82)
Age 18	4804	75.42(70.21,80.63)	77.80 (72.98,82.77)
Lean mass (kg)			
Age 9	7261	-1.85(-1.99,-1.71)	-3.19 (-3.34,-3.04)
Age 18	4819	-17.14(-17.44,-16.84)	-18.39 (-18.66,-18.12)
SBP (mmHg)			
Age 7	8057	0.23(-0.17,0.63)	0.14 (-0.27,0.55)
Age 18	4629	-10.17(-10.66,-9.68)	-10.48 (-11.00,-9.97)
DBP (mmHg)			
Age 7	8057	0.77(0.48,1.06)	0.79 (0.50,1.09)
Age 18	4629	1.55(1.22,1.88)	1.65 (1.27,2.02)
Pulse rate (bpm)			
Age 7	8057	2.61(2.14,3.07)	3.06 (2.58,3.54)
Age 18	4629	4.53(3.99,5.07)	4.68 (4.12,5.24)
Glucose (mmol/l)			
Age 7	5480	-0.08(-0.11,-0.05)	-0.08 (-0.10,-0.05)
Age 18	3266	-0.23(-0.26,-0.21)	-0.22 (-0.25,-0.19)
Log insulin (mu/l)[a]			
Birth	262	7.80(-5.37,20.97)	7.81 (-4.46,21.65)
Age 18	498	21.06(9.94,32.18)	22.85 (10.76,36.25)
Log triglyceride (mmol/l)[a]			
Birth	4770	-1.00(-3.53,1.53)	-0.70 (-3.17,1.84)
Age 18	3254	2.11(-0.41,4.63)	3.80 (1.59,6.06)
HDL-c (mmol/l)			
Birth	4700	0.05(0.03,0.06)	0.05 (0.03,0.06)
Age 18	3277	0.16(0.14,0.18)	0.17 (0.15,0.18)
Non-HDL-c (mmol/l)			
Birth	4620	0.07(0.04,0.10)	0.07 (0.04,0.10)
Age 18	3275	0.20(0.16,0.25)	0.19 (0.16,0.23)

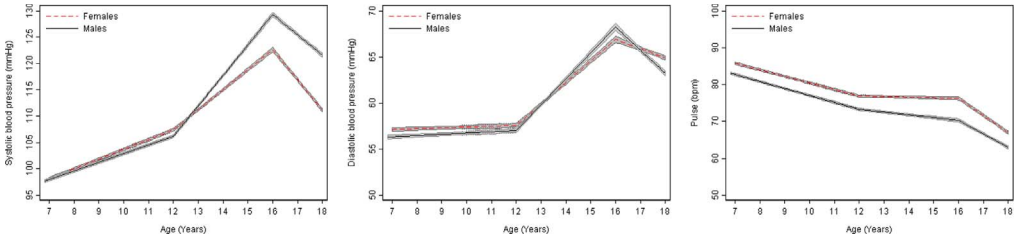
bpm, beats per minute; DBP, diastolic blood pressure; HDL-c, high density lipoprotein; SBP, systolic blood pressure.

[a] Risk factor is log transformed. The difference between females and males for the risk factor is back transformed from the log scale for ease of interpretation and is interpreted as the percentage difference in the mean level comparing females with males at the age shown.



N=8,510 **N=6,502** **N=6,517**

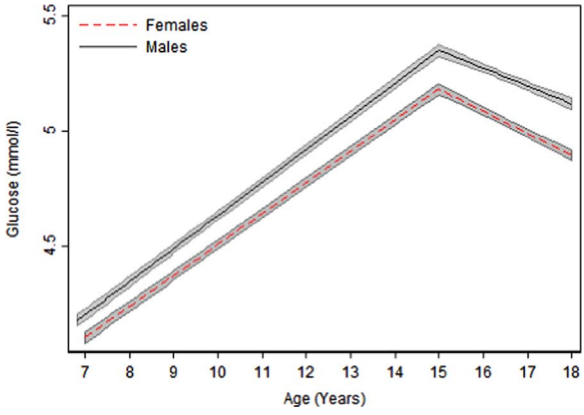
Fig. 1. Mean predicted sex-specific trajectories of BMI (1 to 18 years), height-adjusted fat mass and height-adjusted lean mass (9 to 18 years) among participants with at least one measure before and after 11 years.



N=7,264 **N=7,264** **N=7,264**

Shaded areas represent 95% confidence intervals. Note the different age range on the X axis for each outcome. DBP, diastolic blood pressure; SBP, systolic blood pressure.

Fig. 2. Mean predicted sex-specific trajectories of SBP, DBP and pulse from 7 to 18 years among participants with at least one measure before and after 11 years.

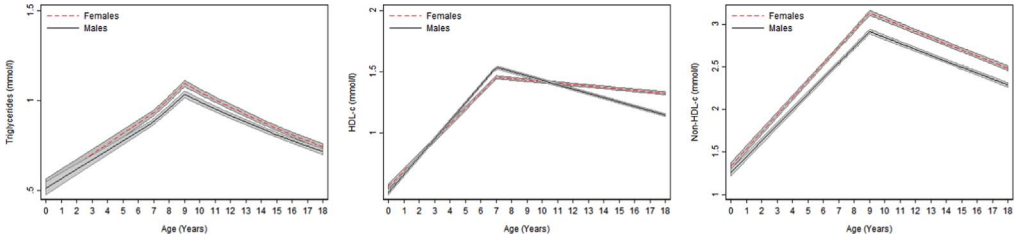


N=2,979

Shaded areas represent 95% confidence intervals.

Note the different age range on the X axis for each outcome

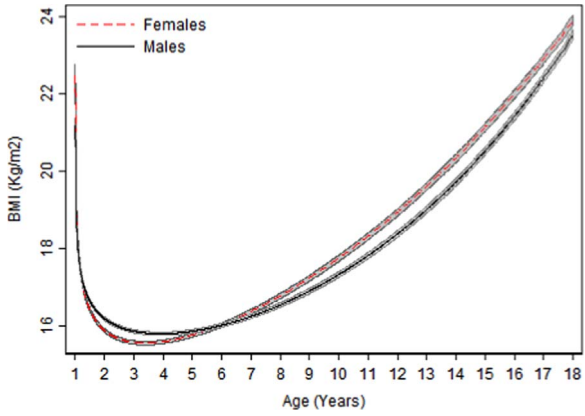
Fig. 3. Mean predicted sex-specific trajectories of glucose from 7 to 18 years among participants with at least one measure before and after 11 years.



N=3,969 **N=3,990** **N=3,982**

Shaded areas represent 95% confidence intervals. Note the different age range on the X axis for each outcome. HDL-c, high density lipoprotein cholesterol

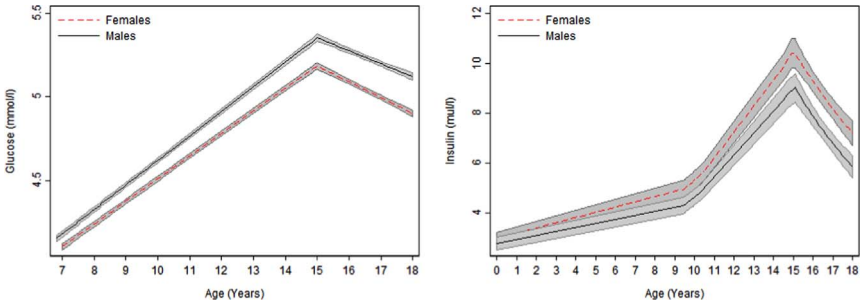
Fig. 4. Mean predicted sex-specific trajectories of triglyceride, HDL-c and non-HDL-c from birth to 18 years among participants with at least one measure before and after 11 years.



N=8,247

Shaded areas represent 95% confidence intervals.
Note the different age range on the X axis for each outcome

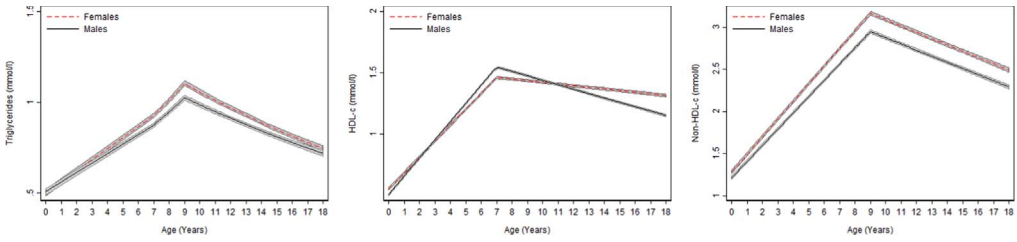
Fig. 5. Mean predicted sex-specific trajectory of BMI from 1 to 18 years among participants with 6 or more measures.



N=7,159 **N=662**

Shaded areas represent 95% confidence intervals. Note the different age range on the X axis for each outcome

Fig. 6. Mean predicted sex-specific trajectories of glucose (7 - 18 years) and insulin (birth - 18 years) excluding participants who reported eating before either the 15- or 18-year clinic.



N=10,074 **N=10,060** **N=10,043**

Shaded areas represent 95% confidence intervals. Note the different age range on the X axis for each outcome. HDL-c, high density lipoprotein cholesterol

Fig. 7. Mean predicted sex-specific trajectories of triglyceride, HDL-c and non-HDL-c from birth to 18 years excluding participants who reported eating before either the 15- or 18-year clinic.

Table 19
Sex differences in glucose from main ALSPAC clinic compared with sex difference in glucose from NMR spectroscopy at 15- and 18-year clinic with females as reference group.

	N participants in regression of risk factor on sex at each age	Difference in females compared with males from main clinic (95% CI)	Difference in females compared with males from NMR spectroscopy (95% CI)
Age 15	3464	-0.16 (-0.19, -0.14)	-0.14 (-0.16, -0.11)
Age 18	3266	-0.23 (-0.26, -0.21)	-0.17 (-0.20, -0.15)

NMR, Nuclear Magnetic Resonance.

Acknowledgements

We are extremely grateful to all the families who took part in this study, the midwives for their help in recruiting them, and the whole ALSPAC team, which includes interviewers, computer and laboratory technicians, clerical workers, research scientists, volunteers, managers, receptionists and nurses.

Financial support

The UK Medical Research Council and Wellcome (Grant ref: 102215/2/13/2) and the University of Bristol provide core support for ALSPAC. This publication is the work of the authors listed and they will serve as guarantors for the contents of this paper. LMOK is supported by a UK Medical Research Council Population Health Scientist fellowship (MR/M014509/1). LDH and AF are supported by Career Development Awards from the UK Medical Research Council (grants MR/M020894/1 and MR/M009351/1, respectively). LMOK, AS, LDH, AF, KT, ELA, and DAL work in a unit that receives funds from the UK Medical Research Council (grant MC_UU_12013/5, MC_UU_12013/2, MC_UU_12013/9, MC_UU_00011/3, MC_UU_00011/6). AH received support from the British Heart Foundation (PG/15/75/31748, CS/15/6/31468, CS/13/1/30327), the Wellcome Trust (086676/7/08/Z), the National Institute for Health Research University College London Hospitals Biomedical Research Centre and works in a unit that receives funds from the UK Medical Research Council (Programme Code MC_UU_12019/1). All the funding sources had no role in the study design, collection, analysis, or interpretation of the data; writing the manuscript; or the decision to submit the paper for publication.

Author contributions

Author contributions for this project are detailed in Ref. [1].

Transparency document. Supporting information

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.01.035.

References

[1] L. O'Keeffe, A. Simpkin, K. Tilling, E. Anderson, A. Hughes, D. Lawlor, et al., Sex-specific trajectories of measures of cardiometabolic health during childhood and adolescence: a prospective cohort study, Atherosclerosis 278 (2018) (2018) 190–196.
[2] A. Boyd, J. Golding, J. Macleod, D.A. Lawlor, A. Fraser, J. Henderson, et al., Cohort profile: the 'Children of the 90s'—the index offspring of the Avon Longitudinal Study of Parents and Children, Int. J. Epidemiol. 42 (1) (2013) 111–127.

[3] A. Fraser, C. Macdonald-Wallis, K. Tilling, A. Boyd, J. Golding, G.D. Smith, et al., Cohort profile: the Avon Longitudinal Study of Parents and Children: ALSPAC mothers cohort, Int. J. Epidemiol. 42 (1) (2013) 97–110.
[4] University of Bristol, Avon Longitudinal Study of Parents and Children [Available from: ⟨http://www.bristol.ac.uk/alspac/researchers/access/⟩, 2017.
[5] L.D. Howe, K. Tilling, A. Matijasevich, E.S. Petherick, A.C. Santos, L. Fairley, et al., Linear spline multilevel models for summarising childhood growth trajectories: a guide to their application using examples from five birth cohorts, Stat. Methods Med. Res. (2013) (0962280213503925).
[6] L.D. Howe, A. Matijasevich, K. Tilling, M.-J. Brion, S.D. Leary, G.D. Smith, et al., Maternal smoking during pregnancy and offspring trajectories of height and adiposity: comparing maternal and paternal associations, Int. J. Epidemiol. 41 (3) (2012) 722–732.
[7] L.M. O'Keeffe, P.M. Kearney, R.A. Greene, L. Zuccolo, K. Tilling, D.A. Lawlor, et al., Maternal alcohol use during pregnancy and offspring trajectories of height and weight: a prospective cohort study, Drug Alcohol Depend. 153 (2015) 323–329.
[8] P. Soininen, A.J. Kangas, P. Würtz, T. Suna, M. Ala-Korpela, Quantitative serum nuclear magnetic resonance metabolomics in cardiovascular epidemiology and genetics, Circ.: Cardiovasc. Genet. 8 (1) (2015) 192–206.
[9] P. Soininen, A.J. Kangas, P. Würtz, T. Tukiainen, T. Tynkkynen, R. Laatikainen, et al., High-throughput serum NMR metabonomics for cost-effective holistic studies on systemic metabolism, Analyst 134 (9) (2009) 1781–1785.
[10] L.M. O'Keeffe, L.D. Howe, A. Fraser, A.D. Hughes, K.H. Wade, E.L. Anderson, et al., Associations of Y chromosomal haplogroups with cardiometabolic risk factors and subclinical vascular measures in males during childhood and adolescence, Atherosclerosis 274 (2018) 94–103.
[11] L.D. Howe, P.G. Parmar, L. Paternoster, N.M. Warrington, J.P. Kemp, L. Briollais, et al., Genetic influences on trajectories of systolic blood pressure across childhood and adolescence, Circ.: Cardiovasc. Genet. 6 (6) (2013) 608–614.
[12] J.R. Staley, J. Bradley, R.J. Silverwood, L.D. Howe, K. Tilling, D.A. Lawlor, et al., Associations of blood pressure in pregnancy with offspring blood pressure trajectories during childhood and adolescence: findings from a prospective study, J. Am. Heart Assoc. 4 (5) (2015) e001422.
[13] T. Morris, K. Northstone, L. Howe, Examining the association between early life social adversity and BMI changes in childhood: a life course trajectory analysis, Pediatr. Obes. (2015).