Supplementary Online Content

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eMethods. Comprehensive details of the measures and statistical analyses used in this study.

eTable 1. Pediatric and adult lipid and lipoprotein cut points (mmol/L) used in the analyses.

eTable 2. Tracking of blood lipid levels from youth to adulthood expressed as proportions in pediatric levels by adult levels.

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This supplementary material has been provided by the authors to give readers additional information about their work.

eMETHODS

Measures

Fasting blood lipid and lipoprotein measurements: In 1985, plasma total cholesterol and triglyceride levels were determined enzymatically, and high-density lipoprotein cholesterol (HDL-C) levels analyzed following precipitation of apoprotein B containing lipoproteins. In 2004 to 2006, serum total cholesterol, triglyceride, and HDL-C concentrations were determined enzymatically.[1] Low-density lipoprotein cholesterol (LDL-C) concentrations were determined using the Friedewald formula.[2]

Lifestyle-related measures: Height and weight were measured and body mass index (BMI) calculated. Waist circumference and skin fold thickness were measured at both time points as we have previously detailed.[3] Participant smoking behaviors were collected through questionnaires administered at baseline and follow-up. Participants that indicated they smoked a cigarette on 1 or more occasions per week were classified as smokers. Cardiorespiratory fitness was estimated at baseline and follow-up as physical working capacity at a heart rate of 170 beats/min on a bicycle ergometer (Monark Exercise AB, Vansbro, Sweden) according to standard protocols.[4] Participants retrospectively reported the highest level of education completed by their mother/female guardian and their father/male guardian (low, school only; medium, trade/vocational certificate; high, university). The highest level of parental education achieved was used as an indicator of youth socioeconomic position (SEP). This type of recall is valid and does not differ by SEP,[5] is a commonly used technique,[5, 6] and most participants (95%) were able to provide this information. At follow-up, self-reported highest level of education completed was used as the indicator of SEP. Participants aged 12 and 15 years at baseline recorded their food consumption over a 24-hour period.[7] The students, in groups of 4 or 5, were given a record diary by a data collector and shown

how to record their food intake with practical examples of food measurement. As a practice exercise, they recorded the breakfast they had eaten that morning. This recording was then checked for the detail necessary to allow coding and conversion into nutrient intake and the participants given feedback. The 24-hour recording period began at the end of the briefing session. Once the 24-hour recoding period had elapsed, each student was interviewed individually, and their record diary was checked to clarify missing or illegible information. At follow-up, food habits and food frequency questionnaires were completed.[8] Scores from 3 questions linked to fat intake (type of milk usually consumed; frequency of trimming fat from meat; and type of spread usually used on bread) were summed to derive a single variable of dietary behavior relating to fat intake at follow-up.[3] The food frequency questionnaire does not allow the proportion of dietary energy from saturated fat to be derived; however, the dietary behavior variables relating to fat intake have been shown to provide reliable and valid estimates[9] that are positively correlated with higher saturated fat intake.[10, 11] At follow-up, females were asked if they were currently using any of the following hormonal contraceptives (HC): combined oral contraceptives, minipill (progesterone-only pill), weekly contraceptive patch, progestogen, progestogen injection, progestin-releasing intrauterine device, or progestin-releasing implant.

Statistical analyses

Tracking of blood lipids from youth to adulthood

Tracking was estimated in 2 ways: (1) Spearman's rank-order correlation coefficients; and (2) the proportion of participants who remained in high-risk categories in youth and adulthood. To classify child and adolescent levels, we used pediatric high-risk cut-points [12, 13] that have been shown to be the best predictors of adult dyslipidemia in data from 3 cohorts [1] (see eTable 1 for values). We used high-risk cut points stipulated by the National Cholesterol Education Program's Adult Treatment

Panel to classify adult levels of total cholesterol (≥240 mg/dL [≥6.22 mmol/L]), LDL-C (≥160 mg/dL [≥4.14 mmol/L]), HDL-C (<40 mg/dL [<1.036 mmol/L]), and triglycerides (≥200 mg/dL [≥2.26 mmol/L]).[14]

Factors affecting stability of blood lipid levels from youth to adulthood

In order to determine the factors that might affect the stability of youth lipid and lipoprotein levels, participants were divided into 4 tracking groups depending on their status in youth and adulthood. Participants who remained in high-risk categories at both time points were considered true-positive; those who were high-risk in youth but not at follow-up were considered false-positive; those who were not high-risk in youth but were in adulthood were considered false-negative; and those who did not have high-risk levels at either time point were considered true-negative (see eFigure 1). This approach has been adopted in other studies examining factors that influence tracking (and thus prediction) of lipid and other risk factor levels between 2 time points.[15-18] In separate analyses for each lipid or lipoprotein, logistic regression was used to examine the effect of changes in lifestyle-related variables (adiposity measures, cardiorespiratory fitness, SEP, smoking, and saturated fat intake) between youth and adulthood that increased the odds of being true-positive (stable tracking) as opposed to false-positives (unstable tracking) in those who were at high risk in youth, and to identify factors that increased the odds of being false-negative (unstable tracking) as opposed to true-negative (stable tracking) in those who were at low risk in youth. The logistic regression models were adjusted for age and sex. If multiple lifestyle variables were found to be associated with tracking of a single lipid or lipoprotein variable, a model that included all significant lifestyle variables in addition to age and sex was fitted to test for independent effects. There were no significant sex interactions, so we did not analyze the data stratified by sex.

Changes in continuous lifestyle-related variables (adiposity measures, cardiorespiratory fitness, and saturated fat intake) were analyzed using the difference (adult minus child) of age- and sex-specific *z* scores at each time point. For change in SEP, a social mobility variable was created,[19] using the highest level of parental education at baseline and highest level of own education at follow-up to derive change or stability in SEP as follows: persistently low (low at baseline and follow-up), persistently medium (medium at baseline and follow-up), persistently high (high at baseline and follow-up), upwardly mobile (moving from low at baseline to medium or high at follow-up, or medium at baseline to high at follow-up), and downwardly mobile (moving from high at baseline to medium or low at follow-up, or from medium at baseline to low at follow-up). Because the baseline level of the lifestyle risk factor may have an effect on the magnitude of change, we also fit models that included the baseline variable as a covariate and examined for interactions between the baseline variable and change. There were no significant interactions. Examining the data with or without the baseline variable in the model produced essentially similar results and did not change the conclusions. Because of this, the results are presented for the more parsimonious model (without the baseline variable as a covariate) because power was a consideration in some of the analyses.

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eTable 1. Pediatric and adult lipid and lipoprotein cut-points (mmol/L) used in the analyses

	Pediatric					Adult
	NCEP	NHANES, age				NCEP
		12 y		15 y		
		Male	Female	Male	Female	
Total cholesterol						
Normal	<4.40	-	-	-	-	<5.18
Borderline high	4.40-5.17	-	-	-	-	5.18-6.21
High	≥5.18	-	-	-	-	≥6.22
LDL-C						
Normal	<2.85	-	-	-	-	<3.37
Borderline high	2.85-3.36	-	-	-	-	3.37-4.13
High	≥3.37	-	-	-	-	≥4.14
HDL-C*						
Normal	>1.56	≥1.70	≥1.48	≥1.55	≥1.49	≥1.55
Borderline low	1.56-0.91	1.69-1.14	1.47-1.04	1.54-1.05	1.48-1.04	1.54-1.036
Low	<0.91	≤1.13	≤1.03	≤1.04	≤1.03	<1.036
Triglycerides						
Normal	<1.02	-	-	-	-	<1.70
Borderline high	1.02-1.46	-	-	-	-	1.70-2.25
High	≥1.47	-	-	-	-	≥2.26

Abbreviations: HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; NCEP, National Cholesterol Education Program; NHANES, National Health and Nutrition Examination Survey.

*As per recommendations from Magnussen et al,[1] we used the NHANES cut points for HDL-C for those aged 12 or 15 years at baseline, and used the NCEP cut points for 9-year-olds. NCEP pediatric cut points are from National Cholesterol Education Program[12] and adult cut points from NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults[14]; NHANES pediatric cut points from Jolliffe and Janssen.[13]

eTable 2. Tracking of blood lipid levels from youth to adulthood expressed as proportions in pediatric levels by adult levels[14-33].

	Males						Females					
	Child classification						Child classification					
	Normal		Borderline-high (low)		High (low)		Normal		Borderline-high (low)		High (low)	
Adult classification	N	%	N	%	N	%	N	%	N	%	N	%
Total cholesterol												
Normal	106	68.0	41	26.3	9	5.8	99	54.1	60	32.8	24	13.1
Borderline-high	28	33.3	44	52.4	12	14.3	12	16.7	31	43.1	29	40.3
High	5	17.2	12	41.4	12	41.4	1	6.7	7	46.7	7	46.7
LDL-C												
Normal	131	78.9	26	15.7	9	5.4	134	67.0	41	20.5	25	12.5
Borderline-high	32	45.1	24	33.8	15	21.1	12	22.2	20	37.0	22	40.7
High	8	32.0	7	28.0	10	40.0	3	23.1	1	7.7	9	69.2
HDL-C												
Normal	17	41.5	24	58.5	0	0.0	67	53.2	59	46.8	0	0.0
Borderline-low	39	23.1	119	70.4	11	6.5	30	23.1	94	72.3	6	4.6
Low	3	5.3	38	66.7	16	28.1	2	15.4	9	69.2	2	15.4
Triglycerides												
Normal	126	58.9	11	5.1	77	36.0	133	53.6	17	6.9	98	39.5
Borderline-high	9	36.0	7	28.0	9	36.0	9	69.2	3	23.1	1	7.7

High	18	60.0	1	3.3	11	36.7	7	77.8	0	0.0	2	22.2

Abbreviations: HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol.
Row totals for percentages may not add to 100 because of rounding. (Low) in table headings refer to the corresponding risk category for HDL-C.

eFigure. Schematic representation of blood lipid and lipoprotein categorical tracking possibilities from youth to adulthood in the CDAH study.