

# Independent Living and Romantic Relations Among Young Adults Born Preterm

Tuija Männistö, MD, PhD<sup>a,b</sup>, Marja Väärasmäki, MD, PhD<sup>b</sup>, Marika Sipola-Leppänen, MD<sup>a,c,d</sup>, Marjaana Tikanmäki, MD<sup>a,d</sup>, Hanna-Maria Matinolli, MHealthSci<sup>e</sup>, Anu-Katriina Pesonen, PhD<sup>e</sup>, Katri Räikkönen, PhD<sup>e</sup>, Marjo-Riitta Järvelin, MD, PhD<sup>d,f,g,h</sup>, Petteri Hovi, MD, PhD<sup>a,i</sup>, Eero Kajantie, MD, PhD<sup>a,b,i</sup>

## abstract

**BACKGROUND:** Young adults born preterm at very low birth weight start families later. Whether less severe immaturity affects adult social outcomes is poorly known.

**METHODS:** The study “Preterm birth and early life programming of adult health and disease” (ESTER, 2009–2011) identified adults born early preterm (<34 weeks’ gestation,  $N = 149$ ), late preterm ( $\geq 34$  to <37 weeks’ gestation,  $N = 248$ ), and at term ( $\geq 37$  weeks’ gestation,  $N = 356$ ) from the Northern Finland Birth Cohort 1986 and the Finnish Medical Birth Register (1987–1989), with perinatal data, medical and family history, socioeconomic status, and lifestyle from routine visits or questionnaires. Cox, logistic, and ordinal regressions estimated the hazard and odds ratios (HR and OR) with 95% confidence intervals of outcomes related to preterm birth.

**RESULTS:** Compared with term-born subjects, those born early and late preterm were less likely to have cohabited with a romantic partner (HR, 0.79; [0.61–1.03] and HR, 0.80; [0.65–0.99], respectively) or experienced sexual intercourse (HR, 0.83; [0.66–1.05] and HR, 0.76; [0.63–0.92], respectively) by young adulthood. They also had higher odds of obtaining a 1-point lower score in a visual analog scale of self-perceived sexual attractiveness (OR, 1.45; [1.09–1.98] and OR, 1.44; [1.06–1.97] for early and late preterm birth, respectively). No difference was observed in the likelihood of departing from childhood home and number of individuals having their own families.

**CONCLUSIONS:** Young adults born preterm experience more social challenges, which may affect their romantic relationships and future family planning.

FREE

**WHAT’S KNOWN ON THIS SUBJECT:** Adults born very preterm or with very low birth weight have a lower likelihood of leaving their childhood home, and starting romantic relationships, and are older when experiencing first intercourse or having their first child than their term-born peers.

**WHAT THIS STUDY ADDS:** Compared with term-born individuals, those born preterm perceived themselves less attractive and were less likely to have cohabited or experienced first-time sexual intercourse by young adulthood. This outcome indicates that social outcomes are different among preterm-born individuals.

<sup>a</sup>Diabetes Prevention Unit, Department of Chronic Disease Prevention, National Institute for Health and Welfare, Helsinki, Finland; <sup>b</sup>Department of Obstetrics and Gynecology and Medical Research Center, Oulu University Hospital and University of Oulu, Oulu, Finland; <sup>c</sup>Department of Pediatrics and Adolescence, Oulu University Hospital, Oulu, Finland; <sup>d</sup>Institute of Health Sciences and Biocenter Oulu, University of Oulu, Oulu, Finland; <sup>e</sup>Institute of Behavioral Sciences, University of Helsinki, Helsinki, Finland; <sup>f</sup>Department of Epidemiology and Biostatistics, MRC Health Protection Agency (HPA) Centre for Environment and Health, School of Public Health, Imperial College London, London, United Kingdom; <sup>g</sup>Department of Children, Young People and Families, National Institute for Health and Welfare, Oulu, Finland; <sup>h</sup>Unit of Primary Care, Oulu University Hospital, Oulu, Finland; and <sup>i</sup>Children’s Hospital, University of Helsinki and Helsinki University Central Hospital, Helsinki, Finland

Dr Männistö designed and carried out the analyses and drafted the initial manuscript; Dr Väärasmäki participated in the study design and data collection and reviewed and revised the manuscript; Drs Sipola-Leppänen, Tikanmäki, and Matinolli participated in the data collection and reviewed and revised the manuscript; Drs Pesonen and Räikkönen drafted some parts of the initial manuscript and reviewed and revised the manuscript; Dr Järvelin participated in the study design and data collection and reviewed and revised the manuscript; Dr Hovi contributed to the conception and design of the study and reviewed and revised the manuscript; Dr Kajantie contributed to the conception and design of the study, was responsible for the data collection, and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

Preterm birth at <37 weeks' gestation affects 11% of all births worldwide and 5% to 12% of births in the United States and Europe.<sup>1</sup> It is a major risk factor for infant mortality and both short- and long-term morbidity, with risks increasing with increasing degree of prematurity.<sup>2-4</sup>

Individuals born very preterm (<32 weeks' gestation) or with very or extremely low birth weight (<1500 and <1000 g, respectively) are at an increased risk for cognitive impairment, learning difficulties, disability, chronic and psychiatric diseases, and emotional and behavioral problems.<sup>3-11</sup> As young adults, these individuals are less likely to leave their parental home,<sup>12</sup> establish friendships,<sup>8</sup> relationships, marriage or cohabitation,<sup>3,4,12,13</sup> experience sexual intercourse for the first time,<sup>12-14</sup> and reproduce.<sup>4,15,16</sup> They also have lower self-perceived attractiveness or romantic confidence,<sup>5,11</sup> and lower educational attainment.<sup>3,4,11,17</sup> Still, those born very preterm or with very low birth weight perceive themselves as healthy and functioning as their peers,<sup>6,18-21</sup> and are less likely to drink alcohol or use illicit drugs.<sup>4,11,13,14</sup>

However, very preterm or very low birth weight infants comprise only a small proportion of all preterm births,<sup>22</sup> and thus late preterm births (births  $\geq 34$  weeks' but <37 weeks' gestation) have a high public health impact despite that the degree of immaturity and risks for morbidity are smaller among individuals born late preterm.<sup>3,4,9,10,17</sup> Similar to studies related to very preterm birth, some studies found lower rates of marriage,<sup>3</sup> cohabitation,<sup>3</sup> and reproduction<sup>15</sup> among adults born moderately to late preterm ( $\geq 32$  weeks' but <37 weeks' gestation) compared with their term-born peers, but others could not confirm these findings.<sup>4</sup>

Given the observed association between very preterm birth and adult

social outcomes and the somewhat inconsistent findings between late preterm birth and these outcomes, we studied these relationships among young adults born early (<34 weeks' gestation) and late preterm, hypothesizing that any level of prematurity will delay or have an adverse effect on adult social milestones while accounting for confounders selected a priori.

## METHODS

The study "Preterm birth and early life programming of adult health and disease" (ESTER) is comprised of young adults recruited among the participants of Northern Finland Birth Cohort 1986 born in 1985-1986,<sup>23</sup> and among all children born 1987-1989 in the 2 northernmost provinces of Finland, identified via the Finnish Medical Birth Register. Exposed subjects were recruited to the ESTER study either because they were born preterm (<37 weeks' gestation) or because they were born from pregnancies complicated with maternal diabetes or hypertensive disorders. Unexposed subjects (ie, those born term and/or without maternal pregnancy complications) were randomly selected from the source populations. Of the eligible 2920 individuals, 39.8% (1161 subjects) participated in a clinical study in 2009-2011 and comprised the ESTER study population. All subjects gave informed written consent and the study has been approved by the Ethics Committees at Helsinki and Uusimaa Hospital District and Northern Ostrobothnia Hospital District. The detailed methods of the ESTER study have been described elsewhere (Marika Sipola-Leppänen, MD; Marja Väärasmäki, MD, PhD; Marjaana Tikanmäki, MD; Hanna-Maria Matinelli, MHealthSci; Satu Miettola, MD; Petteri Hovi, MD, PhD; Karoliina Wehkalampi, MD, PhD; Aimo Ruokonen, MD, PhD; Jouko Sundvall, MD, PhD; Anneli Pouta, MD,

PhD; Johan G. Eriksson, MD, PhD; Marjo-Riitta Järvelin, MD, PhD; Eero Kajantie, MD, PhD, unpublished data, 2014).

Maternal and paternal demographic data, maternal health data, and perinatal data were collected prospectively for the subjects of Northern Finland Birth Cohort 1986 via questionnaires and supplemented with data from antenatal visits to maternity welfare clinics.<sup>23</sup> For the subjects identified via the Medical Birth Register, perinatal data obtained from the register were supplemented with antenatal data from patient records and maternity welfare clinic visits. Maternal pregnancy complications were retrospectively confirmed using prevailing criteria.

In conjunction with a clinical visit in 2009-2011, the ESTER subjects completed questionnaires on family structure, medical history, current health and medications, socioeconomic status, and lifestyle. The questionnaires included detailed questions on living situations throughout childhood and early adulthood as well as questions on romantic relationships, sexual intercourse, and attempts to conceive, which have been previously used when studying adults born preterm at very low birth weight.<sup>12</sup>

The clinical visit also included measurements of anthropometrics and body composition (Marika Sipola-Leppänen, MD; Marja Väärasmäki, MD, PhD; Marjaana Tikanmäki, MD; Hanna-Maria Matinelli, MHealthSci; Satu Miettola, MD; Petteri Hovi, MD, PhD; Karoliina Wehkalampi, MD, PhD; Aimo Ruokonen, MD, PhD; Jouko Sundvall, MD, PhD; Anneli Pouta, MD, PhD; Johan G. Eriksson, MD, PhD; Marjo-Riitta Järvelin, MD, PhD; Eero Kajantie, MD, PhD, unpublished data, 2014). Gestational length was based on the best available estimate determined by ultrasound for 438 (58.2%) subjects and by data on last menstrual period for 315 (41.8%) subjects. Length of gestation was

thoroughly reviewed and confirmed from medical records in case of discrepancies.<sup>24</sup>

The current analysis was restricted to the subjects recruited owing to being born preterm and included 149 subjects born early preterm (<34 weeks' gestation), 248 subjects born late preterm (at  $\geq 34$  but <37 weeks' gestation), and 356 term born ( $\geq 37$  weeks' gestation) controls. Preterm and term-born subjects participating in the ESTER study were similar to those not participating by maternal and paternal characteristics and perinatal data, but the ESTER study participants born late preterm and at term were less often male than those not participating, and the study participants born early preterm had fewer physical disabilities than the non-participants (data not shown).

### Study Outcomes

Outcomes of interest included moving out of childhood home, first time cohabiting with a romantic partner, first time experiencing sexual intercourse, self-perceived sexual attractiveness (assessed on a visual analog scale with full figures from 0 to 10), number of children and attempts to conceive by the time of the study, the perceived ideal age to have the first child, and the ideal number of children during life-course.

### Statistical Analyses

Differences in parental and perinatal data, current demographic characteristics, and outcomes were tabulated using contingency tables. We used  $\chi^2$  tests (categorical variables) and univariate analysis of variance (continuous variables) for statistical analyses. Those missing outcome data or timing on outcomes were excluded in the analyses of the outcome in question but retained in other analyses.

Cox regression was used to estimate the hazard ratios (HRs) with 95% confidence intervals (CIs) for time-

dependent outcomes, including first time moving from childhood home, cohabiting with a romantic partner, and experiencing sexual intercourse. Subjects not experiencing these events by the time of the study were censored. The age of the subjects was used as the time scale to account for differences in baseline hazards by age and subtle differences in age between groups. The proportional hazard assumption of the models was verified by testing an interaction of each predictor and covariate with time. When non-proportional hazards were observed, the variable with non-proportional hazards was modeled as time-dependent, assuming a linear relationship between the coefficient and time. Logistic and ordinal regression was used to estimate the respective odds ratios (ORs) and 95% CIs of binary outcomes (having children and ever trying to conceive) and ordinal outcomes (ideal age to have first child, ideal number of children, and self-perceived sexual attractiveness).

All statistical analyses were adjusted for the highest educational attainment of parents, major mental or physical impairment (cerebral palsy, mental disability, and severe physical disability), multiple pregnancies, subject's gender, and a cohort indicator to account for differences in perinatal data collection.<sup>25</sup> We observed non-proportional hazards with parental education and subject's gender in the model evaluating HRs of living outside of childhood home, and with subject's gender in the model estimating HRs of ever cohabiting, and appropriate covariate interactions with time were modeled. In the statistical analyses of sexual and reproductive health outcomes, we additionally adjusted for maternal BMI before pregnancy (calculated as  $\text{weight/height}^2$  in  $\text{kg/m}^2$ ), hypertension during pregnancy, and smoking during pregnancy.<sup>25</sup> All models were selected a priori.

We also evaluated the controlled direct effect of preterm birth on perceived sexual attractiveness independent of current BMI or height. These models included either current BMI or height and were adjusted for covariates assumed to affect preterm birth and self-perceived attractiveness (parental education, major birth defects, multiple pregnancies, subject's gender, cohort indicator, maternal pre-pregnancy BMI, and hypertension and smoking during pregnancy).<sup>25</sup> The model with current BMI was also adjusted with highest educational attainment of the subject and number of siblings in the family and the model with current height was adjusted with maternal and paternal heights.

We performed a complete case analysis as a sensitivity analysis in which we excluded all subjects missing outcome or covariate data, and separate analyses in which subjects who had major birth defects were excluded. All statistical analyses were performed by using SPSS version 21 (IBM SPSS Statistics, IBM Corporation).

### RESULTS

Subjects born preterm were slightly younger, more often twins, and born small for gestational age than those born at term (Table 1). Additionally, the mothers of those born preterm remained less often normotensive during pregnancy and were less often normal weight before pregnancy (Table 1).

By the time of the study, fewer subjects born either early or late preterm had ever lived outside of their childhood home than term subjects (Table 2), although this difference was not significant in the survival models accounting for age to event (Table 3). Those born late preterm were 20% less likely to have ever cohabited with a romantic partner and 24% less likely to have experienced sexual intercourse (Tables 2 and 3). Similar findings were seen among subjects born early

**TABLE 1** The Demographic and Clinical Characteristics of Subjects Born Preterm and Term, the ESTER Study (2009–2011)

	Early Preterm Birth	Late Preterm Birth	Term Birth	<i>P</i> Value <sup>a</sup>
	149 (19.8)	248 (32.9)	356 (47.3)	
<b>Demographics</b>				
Male	68 (45.6)	121 (48.8)	170 (47.8)	.83
Twins	34 (22.8)	33 (13.3)	4 (1.1)	<.001
Recruited via Northern Finland Birth Cohort 1986	51 (34.2)	110 (44.4)	214 (60.1)	<.001
<b>Number of siblings</b>				
0	2 (1.3)	7 (2.8)	8 (2.2)	
1	57 (38.3)	87 (35.1)	106 (29.8)	.48
2	41 (27.5)	70 (28.2)	119 (33.4)	
≥3	49 (32.9)	84 (33.9)	123 (34.6)	
<b>Perinatal and pregnancy characteristics</b>				
Mean gestational age at birth, wk (SD)	31.7 (2.0)	35.8 (0.8)	40.1 (1.2)	<.001
Mean birth weight, g (SD) [min–max]	1760 (491) [615–3010]	2667 (514) [1410–4440]	3575 (485) [2310–5060]	<.001
Subject born small for gestational age	26 (17.4)	31 (12.5)	7 (2.0)	<.001
Mother normotensive during pregnancy	88 (59.9)	170 (70.0)	281 (80.3)	<.001
Mother smoked during pregnancy	24 (16.1)	47 (19.0)	57 (16.0)	.61
<b>Maternal pre-pregnancy weight category<sup>a</sup></b>				
Normal	103 (69.1)	169 (68.1)	267 (75.0)	
Underweight	8 (5.4)	23 (9.3)	24 (6.7)	.18
Overweight/obese	29 (19.5)	49 (19.8)	51 (14.3)	
Missing	9 (6.0)	7 (2.8)	14 (3.9)	
<b>Major mental or physical impairment</b>				
Highest educational attainment of either parent	10 (6.7)	1 (0.4)	4 (1.1)	<.001
<b>Highest educational attainment of either parent</b>				
Basic education or less or unknown education level	14 (9.4)	25 (10.1)	24 (6.7)	
Secondary education (high school or similar)	90 (60.4)	138 (55.6)	216 (60.7)	.66
Lower level tertiary education (college or similar)	14 (9.4)	31 (12.5)	45 (12.6)	
Upper level tertiary education (university or similar)	31 (20.8)	54 (21.8)	71 (19.9)	
<b>Current characteristics of the study subjects</b>				
Mean age at study examination, y (SD)	23.0 (1.4)	23.1 (1.3)	23.6 (1.1)	<.001
<b>Current weight category<sup>b</sup></b>				
Normal	97 (65.1)	151 (60.9)	227 (63.8)	
Underweight	8 (5.4)	10 (4.0)	11 (3.1)	.62
Overweight/obese	44 (29.5)	87 (35.1)	118 (33.1)	
<b>Highest educational attainment<sup>c</sup></b>				
Basic education or less or unknown education level	14 (9.4)	20 (8.1)	30 (8.4)	
Vocational education	53 (35.6)	74 (29.8)	111 (31.2)	.84
Other secondary education (high school or similar)	62 (41.6)	124 (50.0)	171 (48.0)	
Tertiary education (college or similar)	20 (13.4)	30 (12.1)	44 (12.4)	

All data are presented as *n* (%) unless otherwise specified.

<sup>a</sup> *P* values are obtained from  $\chi^2$  tests for categorical variables and univariate analysis of variance for continuous variables.

<sup>b</sup> Defined by using BMI (weight/height<sup>2</sup> in kg/m<sup>2</sup>) and categorized as: normal weight, BMI 18.5 to 24.9; underweight, BMI <18.5; and overweight/obese, BMI ≥25.0.

<sup>c</sup> Either achieved education level or the highest educational level the subject currently pursues.

preterm, but the differences were not statistically significant after adjusting for covariates (Tables 2 and 3).

Overall, 13.3% (*n* = 100) of the study subjects had tried to conceive; 18 subjects or their partners were pregnant at the time of the study. Eighty-seven subjects (11.6%) and/or their partners already had biological or adopted children. The rates and odds of those who had tried to conceive or had children were similar between subjects born preterm and term (Tables 2 and 3). Preterm and term-born subjects also had a similar

perception of the ideal age to have a first child and ideal number of children during the life-course.

However, subjects born early preterm had a tendency toward higher ideal age to have the first child (Tables 2 and 3).

Those born early and late preterm were 47% and 44%, respectively, more likely to have a 1-point lower score in the self-perceived sexual attractiveness scale from 0 to 10 than term-born subjects (Tables 2 and 3).

The estimated controlled direct effects of preterm birth of 1-point lower score in self-rated sexual attractiveness were

OR, 1.80 (95% CI, 1.22–2.65) and OR, 1.42 (95% CI, 1.04–1.94) for early and late preterm birth, respectively, when accounting for current BMI, and OR, 1.82 (95% CI, 1.04–2.06) and OR, 1.46 (95% CI, 1.04–2.06) for early and late preterm birth, respectively, when accounting for current height. As these results are similar to the total effects model, they suggest little mediating effect by current BMI and height in the pathway from preterm birth to self-perceived attractiveness.

All results were similar in our sensitivity analyses excluding

**TABLE 2** The Rates of Outcomes Related to Transitions Into Adulthood Among the ESTER Study Subjects (2009–2011)

	Early Preterm Birth	Late Preterm Birth	Term Birth	<i>P</i> Value <sup>a</sup>
	149 (19.8)	248 (32.9)	356 (47.3)	
Ever lived outside of childhood home	132 (88.6)	220 (88.7)	337 (94.7)	.007
Missing	5 (3.4)	8 (3.2)	9 (2.5)	
Ever cohabited with a romantic partner	82 (55.0)	140 (56.5)	253 (71.1)	<.001
Missing	5 (3.4)	8 (3.2)	9 (2.5)	
Ever experienced sexual intercourse	124 (83.2)	195 (78.6)	312 (87.6)	.006
Missing	7 (4.7)	16 (6.5)	24 (6.7)	
Ever tried to conceive <sup>b</sup>	16 (11.9)	29 (12.8)	55 (17.0)	.24
Missing	14 (9.4)	22 (8.9)	32 (9.0)	
Has own children	16 (10.7)	26 (10.5)	45 (12.6)	.65
Missing	6 (4.1)	17 (6.9)	23 (6.5)	
Ideal age to have first child, y				
<25	28 (18.8)	45 (18.1)	70 (19.7)	
25 to 29.9	63 (48.5)	132 (58.7)	182 (57.6)	.33
≥30	39 (30.0)	48 (21.3)	64 (20.3)	
Missing	19 (12.8)	23 (9.3)	40 (11.2)	
Ideal number of children				
0	12 (8.1)	14 (5.6)	23 (6.5)	
1 to 2	73 (49.0)	116 (46.8)	152 (42.7)	
3 to 4	41 (27.5)	78 (31.5)	125 (35.1)	.67
≥4	8 (5.4)	15 (6.0)	19 (5.3)	
Missing	15 (10.1)	25 (10.1)	37 (10.4)	
Mean self-perceived sexual attractiveness score (SD) <sup>c</sup>	6.2 (1.8)	6.5 (1.7)	6.9 (1.6)	.001
Missing	10 (6.7)	16 (6.5)	24 (6.7)	

All data are presented as *n* (%) unless otherwise specified.

<sup>a</sup> *P* values are obtained from  $\chi^2$  test for categorical variables or from univariate analysis of variance for continuous variables.

<sup>b</sup> Includes 18 individuals who are currently pregnant.

<sup>c</sup> Rated in a visual analog scale from 1 (lowest) to 10 (highest).

subjects who had missing data on outcomes or covariates or excluding subjects who had major mental or physical disabilities (data not shown).

## DISCUSSION

In this study of young adults born early and late preterm and at term, we found that those born preterm rated themselves less sexually attractive and were less likely to have experienced sexual intercourse for the first time and were also less likely to have cohabited with a romantic partner than their term-born peers. All observed associations were fairly similar among those born early and late preterm, fitting our hypothesis that any level of prematurity will have an effect on adult social

milestones. Our findings have widespread implications showing that the adult social outcomes related to preterm birth are not limited to those born with the most severe immaturity but extend to the large number of individuals born late preterm as well.

Previous research on the adult social outcomes of preterm-born subjects has mostly focused on those born very preterm or with very or extremely low birth weight, groups that comprise approximately only 0.5% to 1.5% of newborns depending on definitions.<sup>22</sup> These previous studies have shown that adults born very preterm or with very or extremely low birth weight are less likely to leave their parental home, to establish relationships, cohabitation,

or marriage, and to have had intercourse,<sup>3,4,12–14</sup> although contradicting results are also reported.<sup>11</sup> Moster et al has previously shown that all subjects born preterm were less likely to be married, and the rates of marriage decreased with increasing immaturity.<sup>3</sup> One study found no difference in the rates of partnering among individuals born late preterm,<sup>4</sup> and another study examining all preterm births found no difference in rates of marriage.<sup>26</sup>

We found that young adults born early or late preterm were less likely to have ever cohabited or engaged in sexual intercourse. Younger age at first sexual intercourse is associated with increased risk for sexually transmitted diseases and risk-taking behavior, such as smoking and binge drinking.<sup>27</sup> Prematurity on the other hand is associated with personality profiles in adulthood characterized by over-controlling or inhibited tendencies, such as cautiousness, dutifulness, and fewer risk-taking or fun-seeking behaviors.<sup>18,26,28–30</sup> Adolescents who have over-controlling tendencies have fewer intimate relationships,<sup>31</sup> and individuals who have inhibited tendencies have lower likelihood of having a stable romantic partner in young adulthood and get involved with such relationships later than control subjects.<sup>32,33</sup> Although we observed that preterm-born individuals were less likely to engage in romantic relations in young adulthood, they had similar likelihood of moving out of their childhood home as their term-born peers. Overall, the findings of our study may reflect personality differences between preterm and term-born individuals that manifest in different temporal trajectories of interpersonal growth in young adulthood.

Individuals born early or very preterm have been reported to have lower levels of reproduction, but more conflicting results have been



**TABLE 3** The Risks and Odds of Outcomes Related to Transition Into Adulthood, the ESTER Study (2009–2011)

Outcome	Early Preterm Birth	Late Preterm Birth
	149 (19.8)	248 (32.9)
Ever lived outside of childhood home		
Unadjusted HR (95% CI)	0.95 (0.78–1.17)	0.93 (0.78–1.11)
Adjusted HR (95% CI) <sup>a</sup>	1.00 (0.81–1.25)	0.96 (0.80–1.14)
Ever cohabited with a romantic partner		
Unadjusted HR (95% CI)	0.77 (0.59–0.99)	0.78 (0.64–0.97)
Adjusted HR (95% CI) <sup>b</sup>	0.79 (0.61–1.03)	0.80 (0.65–0.99)
Ever experienced sexual intercourse		
Unadjusted HR (95% CI)	0.79 (0.63–0.99)	0.76 (0.63–0.92)
Adjusted HR (95% CI) <sup>c</sup>	0.83 (0.66–1.05)	0.76 (0.63–0.92)
Ever tried to conceive		
Unadjusted OR (95% CI)	0.66 (0.36–1.20)	0.72 (0.44–1.17)
Adjusted OR (95% CI) <sup>d</sup>	0.88 (0.45–1.70)	0.75 (0.45–1.27)
Has own children		
Unadjusted OR (95% CI)	0.81 (0.44–1.48)	0.81 (0.49–1.36)
Adjusted OR (95% CI) <sup>d</sup>	0.96 (0.48–1.92)	0.82 (0.47–1.43)
Odds of higher category in ideal age to have first child		
Unadjusted OR (95% CI)	1.37 (0.92–2.04)	1.10 (0.79–1.53)
Adjusted OR (95% CI) <sup>d</sup>	1.53 (0.99–2.36)	1.16 (0.82–1.64)
Odds of higher category in ideal number of children		
Unadjusted OR (95% CI)	0.73 (0.50–1.08)	0.93 (0.67–1.28)
Adjusted OR (95% CI) <sup>d</sup>	0.77 (0.51–1.18)	0.89 (0.63–1.26)
Odds of 1-point lower score in self-perceived sexual attractiveness scale		
Unadjusted OR (95% CI)	1.90 (1.33–2.70)	1.47 (1.09–1.98)
Adjusted OR (95% CI) <sup>d</sup>	1.75 (1.06–1.97)	1.44 (1.06–1.97)

The HRs are obtained from Cox regression with subject's age as time scale and the recruitment cohort as stratum. The ORs are obtained from logistic or ordinal regression. Term births ( $N = 356$ ) act as comparison group in all the analyses.

<sup>a</sup> The model is adjusted for parental education, multiple pregnancy, subject's gender, birth defects, and interactions of parental education and subject's gender with time to account for non-proportional hazards.

<sup>b</sup> The model is adjusted for parental education, multiple pregnancy, subject's gender, birth defects, and interaction of subject's gender with time to account for non-proportional hazards.

<sup>c</sup> The model is adjusted for parental education, multiple pregnancy, subject's gender, birth defects, maternal smoking during pregnancy, maternal pre-pregnancy BMI, and maternal hypertension during pregnancy.

<sup>d</sup> The model is adjusted for recruitment cohort, parental education, multiple pregnancy, subject's gender, birth defects, maternal smoking during pregnancy, maternal pre-pregnancy BMI, and maternal hypertension during pregnancy.

reported among those born late preterm.<sup>3,4,15,16</sup> We observed no difference in the likelihood of already having or currently wanting a child by preterm status. We note that our study subjects were relatively young (mean age, 23.3 years; range, 19.9–26.3 years) regarding parenthood at the time of our study, as the average age of first-time mothers was 28.4 years in Finland in 2012.<sup>34</sup> However, we did observe a tendency toward higher age group preference to have the first child among subjects born early preterm, although this finding did not reach statistical significance. Longer follow-up is required to determine if there

are any differences in the lifetime rates of reproduction among preterm and term-born individuals.

Our findings of lower scores in self-perceived sexual attractiveness among adults born early and late preterm are novel. Although the observed difference in the self-perceived attractiveness among those born preterm and term was small, we believe that the difference also contributed to the lower likelihood of having cohabited with a romantic partner and having had sexual intercourse by young adulthood among those born preterm. Previously, adolescents born with extremely low birth weight have been

reported to have lower romantic confidence,<sup>5</sup> and young adults born with very low birth weight were less likely to perceive themselves as attractive as their peers.<sup>11</sup> Preterm-born individuals have reported lower athletic competence, physical functioning, and physical activity,<sup>5,11,18</sup> which might affect their self-perceived body image. Those born preterm or with very low birth weight also often have growth problems and in some populations also higher rates of obesity,<sup>11</sup> both of which might affect the self-perceived attractiveness. Indeed, Cooke et al showed that especially women born with low birth weight hoped to be taller in young adulthood.<sup>11</sup> We accounted for current BMI and current height to estimate if current body size has an influence on the self-perceived attractiveness. As the results were similar to the total effects model, it seems that most of our observed association was probably driven by preterm birth, although we cannot rule out effects of unmeasured confounders.

The strengths of our study include reliable assessment of gestational length and multitude of pregnancy-related data obtained during visits to maternity welfare clinics. We also had representative groups of young adults born both early and late preterm, allowing for estimation of risks across degrees of prematurity. The relatively small number of subjects born very preterm is a limitation, as only 63 (42%) of subjects born early preterm were born <32 weeks' gestation. It may also explain why we did not observe greater risks among those who had early preterm births, which would have been expected based on previous literature.

## CONCLUSIONS

Young adults born early and late preterm had a lower likelihood of establishing a cohabiting relationship with a romantic partner or having had

sexual intercourse and they perceived themselves less attractive than their term-born peers. Our findings

implicate that young adults born preterm, including the large proportion born late preterm,

experience more social challenges that may affect their romantic relationships and future family planning.

[www.pediatrics.org/cgi/doi/10.1542/peds.2014-1345](http://www.pediatrics.org/cgi/doi/10.1542/peds.2014-1345)

DOI: 10.1542/peds.2014-1345

Accepted for publication Nov 5, 2014

Address correspondence to Tuija Männistö, MD, PhD, Diabetes Prevention Unit, Department of Chronic Disease Prevention, National Institute for Health and Welfare, Kastelli Research Centre, PO Box 310, 90101 Oulu, Finland. E-mail: [tuija.mannisto@thl.fi](mailto:tuija.mannisto@thl.fi)

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2015 by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** The authors have indicated they have no financial relationships relevant to this article to disclose.

**FUNDING:** Supported in part by the Finnish Special Governmental Subsidiary for Health Sciences, and in part by grants from Academy of Finland, Emil Aaltonen Foundation, Finnish Foundation for Pediatric Research, Juho Vainio Foundation, Novo Nordisk Foundation, Signe and Ane Gyllenberg Foundation, Sigrid Jusélius Foundation, and Yrjö Jahnsson Foundation.

**POTENTIAL CONFLICT OF INTEREST:** The authors have indicated they have no potential conflicts of interest to disclose.

## REFERENCES

1. Blencowe H, Cousens S, Oestergaard MZ, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *Lancet*. 2012; 379(9832):2162–2172
2. Kramer MS, Demissie K, Yang H, Platt RW, Sauvé R, Liston R; Fetal and Infant Health Study Group of the Canadian Perinatal Surveillance System. The contribution of mild and moderate preterm birth to infant mortality. *JAMA*. 2000;284(7):843–849
3. Moster D, Lie RT, Markestad T. Long-term medical and social consequences of preterm birth. *N Engl J Med*. 2008;359(3): 262–273
4. D'Onofrio BM, Class QA, Rickert ME, Larsson H, Långström N, Lichtenstein P. Preterm birth and mortality and morbidity: a population-based quasi-experimental study. *JAMA Psychiatry*. 2013;70(11):1231–1240
5. Grunau RE, Whitfield MF, Fay TB. Psychosocial and academic characteristics of extremely low birth weight (< or =800 g) adolescents who are free of major impairment compared with term-born control subjects. *Pediatrics*. 2004;114(6). Available at: [www.pediatrics.org/cgi/content/full/114/6/e725](http://www.pediatrics.org/cgi/content/full/114/6/e725)
6. Dahl LB, Kaarensen PI, Tunby J, Handegård BH, Kvernmo S, Rønning JA. Emotional, behavioral, social, and academic outcomes in adolescents born with very low birth weight. *Pediatrics*. 2006;118(2). Available at: [www.pediatrics.org/cgi/content/full/118/2/e449](http://www.pediatrics.org/cgi/content/full/118/2/e449)
7. Hack M, Youngstrom EA, Cartar L, et al. Behavioral outcomes and evidence of psychopathology among very low birth weight infants at age 20 years. *Pediatrics*. 2004;114(4):932–940
8. Lund LK, Vik T, Lydersen S, et al. Mental health, quality of life and social relations in young adults born with low birth weight. *Health Qual Life Outcomes*. 2012;10:146
9. Ekeus C, Lindström K, Lindblad F, Rasmussen F, Hjern A. Preterm birth, social disadvantage, and cognitive competence in Swedish 18- to 19-year-old men. *Pediatrics*. 2010;125(1). Available at: [www.pediatrics.org/cgi/content/full/125/1/e67](http://www.pediatrics.org/cgi/content/full/125/1/e67)
10. Lindström K, Lindblad F, Hjern A. Psychiatric morbidity in adolescents and young adults born preterm: a Swedish national cohort study. *Pediatrics*. 2009; 123(1). Available at: [www.pediatrics.org/cgi/content/full/123/1/e47](http://www.pediatrics.org/cgi/content/full/123/1/e47)
11. Cooke RW. Health, lifestyle, and quality of life for young adults born very preterm. *Arch Dis Child*. 2004;89(3):201–206
12. Kajantie E, Hovi P, Räikkönen K, et al. Young adults with very low birth weight: leaving the parental home and sexual relationships—Helsinki Study of Very Low Birth Weight Adults. *Pediatrics*. 2008; 122(1). Available at: [www.pediatrics.org/cgi/content/full/122/1/e62](http://www.pediatrics.org/cgi/content/full/122/1/e62)
13. Hille ET, Dorrepaal C, Perenboom R, et al. Social lifestyle, risk-taking behavior, and psychopathology in young adults born very preterm or with a very low birthweight. *J Pediatr*. 2008;152(6):793–800
14. Roberts G, Burnett AC, Lee KJ, et al. Quality of life at age 18 years after extremely preterm birth in the post-surfactant era. *J Pediatr*. 2013;163(4):1008–1013.e1
15. deKeyser N, Josefsson A, Bladh M, Carstensen J, Finnström O, Sydsjö G. Premature birth and low birthweight are associated with a lower rate of reproduction in adulthood: a Swedish population-based registry study. *Hum Reprod*. 2012;27(4):1170–1178
16. Swamy GK, Ostbye T, Skjaerven R. Association of preterm birth with long-term survival, reproduction, and next-generation preterm birth. *JAMA*. 2008; 299(12):1429–1436
17. Lindström K, Winbladh B, Haglund B, Hjern A. Preterm infants as young adults: a Swedish national cohort study. *Pediatrics*. 2007;120(1):70–77
18. Baumgardt M, Bucher HU, Mieth RA, Fauchère JC. Health-related quality of life of former very preterm infants in adulthood. *Acta Paediatr*. 2012;101(2):e59–e63

19. Gray R, Petrou S, Hockley C, Gardner F. Self-reported health status and health-related quality of life of teenagers who were born before 29 weeks' gestational age. *Pediatrics*. 2007;120(1). Available at: [www.pediatrics.org/cgi/content/full/120/1/e86](http://www.pediatrics.org/cgi/content/full/120/1/e86)
20. Gäddlin PO, Finnström O, Sydsjö G, Leijon I. Most very low birth weight subjects do well as adults. *Acta Paediatr*. 2009;98(9):1513–1520
21. Heinonen K, Pesonen AK, Lahti J, et al. Self- and parent-rated executive functioning in young adults with very low birth weight. *Pediatrics*. 2013;131(1). Available at: [www.pediatrics.org/cgi/content/full/131/1/e243](http://www.pediatrics.org/cgi/content/full/131/1/e243)
22. Hamilton BE, Martin JA, Ventura SJ. Births: preliminary data for 2012. *Natl Vital Stat Rep*. 2013;62(3):1–20
23. Järvelin MR, Elliott P, Kleinschmidt I, et al. Ecological and individual predictors of birthweight in a northern Finland birth cohort 1986. *Paediatr Perinat Epidemiol*. 1997;11(3):298–312
24. Sipola-Leppänen M, Väärasmäki M, Tikanmäki M, et al. Cardiovascular risk factors in adolescents born preterm. *Pediatrics*. 134(4). Available at: [www.pediatrics.org/cgi/content/full/134/4/e1072](http://www.pediatrics.org/cgi/content/full/134/4/e1072)
25. Berkowitz GS, Blackmore-Prince C, Lapinski RH, Savitz DA. Risk factors for preterm birth subtypes. *Epidemiology*. 1998;9(3):279–285
26. Dalziel SR, Lim VK, Lambert A, et al. Psychological functioning and health-related quality of life in adulthood after preterm birth. *Dev Med Child Neurol*. 2007;49(8):597–602
27. Olesen TB, Jensen KE, Nygård M, et al. Young age at first intercourse and risk-taking behaviours—a study of nearly 65 000 women in four Nordic countries. *Eur J Public Health*. 2012;22(2):220–224
28. Pesonen AK, Räikkönen K, Heinonen K, et al. Personality of young adults born prematurely: the Helsinki study of very low birth weight adults. *J Child Psychol Psychiatry*. 2008;49(6):609–617
29. Pyhälä R, Räikkönen K, Pesonen AK, et al. Behavioral inhibition and behavioral approach in young adults with very low birth weight – The Helsinki Study of Very Low Birth Weight Adults. *Pers Individ Dif*. 2009;46:106–110
30. Strang-Karlsson S, Räikkönen K, Pesonen AK, et al. Very low birth weight and behavioral symptoms of attention deficit hyperactivity disorder in young adulthood: the Helsinki study of very-low-birth-weight adults. *Am J Psychiatry*. 2008;165(10):1345–1353
31. Meeus W, Van de Schoot R, Klimstra T, Branje S. Personality types in adolescence: change and stability and links with adjustment and relationships: a five-wave longitudinal study. *Dev Psychol*. 2011;47(4):1181–1195
32. Asendorpf JB, Denissen JJ, van Aken MA. Inhibited and aggressive preschool children at 23 years of age: personality and social transitions into adulthood. *Dev Psychol*. 2008;44(4):997–1011
33. Leikas S, Salmela-Aro K. Personality types during transition to young adulthood: how are they related to life situation and well-being? *J Adolesc*. 2014;37(5):753–762
34. Vuori E, Gissler M. *Perinatal Statistics: Parturients, Deliveries and Newborns 2012*. Helsinki, Finland: National Institute for Health and Welfare; 2013



## Independent Living and Romantic Relations Among Young Adults Born Preterm

Tuija Männistö, Marja Vääräsmäki, Marika Sipola-Leppänen, Marjaana Tikanmäki, Hanna-Maria Matinolli, Anu-Katriina Pesonen, Katri Räikkönen, Marjo-Riitta Järvelin, Petteri Hovi and Eero Kajantie

*Pediatrics* originally published online January 26, 2015;

### Updated Information & Services

including high resolution figures, can be found at:  
<http://pediatrics.aappublications.org/content/early/2015/01/20/peds.2014-1345>

### Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:  
<http://www.aappublications.org/site/misc/Permissions.xhtml>

### Reprints

Information about ordering reprints can be found online:  
<http://www.aappublications.org/site/misc/reprints.xhtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **Independent Living and Romantic Relations Among Young Adults Born Preterm**

Tuija Männistö, Marja Vääräsmäki, Marika Sipola-Leppänen, Marjaana Tikanmäki, Hanna-Maria Matinolli, Anu-Katriina Pesonen, Katri Räikkönen, Marjo-Riitta Järvelin, Petteri Hovi and Eero Kajantie

*Pediatrics* originally published online January 26, 2015;

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://pediatrics.aappublications.org/content/early/2015/01/20/peds.2014-1345>

Pediatrics is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. Pediatrics is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2015 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 1073-0397.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

