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Epidemiology

Adolescent parenthood associated with adverse socio-economic outcomes at age 30 years in women and men of the Pelotas, Brazil: 1982 Birth Cohort Study

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Objective To investigate the potential long-term effects of adolescent parenthood on completed education and income.

Design Population-based birth cohort study.

Setting All live births in 1982, whose mothers lived in the urban area of Pelotas, southern Brazil.

Sample A total of 3701 participants: 1914 women and 1787 men at age 30 years.

Methods Questionnaires were completed by the mothers in the early phases of this study, and by the cohort members in adolescence and adulthood. Linear regression models and G-computation were used in the analyses.

Main outcome measures Educational attainment and income at age 30 years.

Results In women, adolescent parenthood was associated with lower attained education compared with women without adolescent maternity: by −2.8 years [95% confidence interval (CI) −3.2 to −2.3] if their first birth was at age 16–19, and by −4.4 years (−5.5 to −3.3) at age 11–15. These effects were greater among women who had three or more children. Women with adolescent parenthood also had 49 or 33% lower income at age 30 if their first child was born when aged 16–19 or 11–15, respectively. In men, the adverse effect of adolescent parenthood on education appeared to be mediated by a higher number of children and there was no effect of adolescent paternity on income at age 30 years.

Conclusion These findings suggest lasting socio-economic disadvantages of adolescent parenthood, with larger effects being apparent in women than in men.

Keywords Adolescent, cohort studies, education, income, parents.

Tweetable abstract Adolescent parenthood has an adverse effect on educational attainment later in life, and on household income among women.

Linked article This article is commented on by L Bahamondes, p. 368 in this issue. To view this mini commentary visit https://doi.org/10.1111/1471-0528.15488.

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Introduction

Birth rates among adolescents have declined worldwide since 1990. However, maternal mortality among women who had a child between 15 and 19 years of age is double that of mothers over 20 years of age and is five times higher in mothers under 15 years of age. In addition, mortality and low birthweight are higher among the offspring of adolescent mothers.[1]

About 11% of all births worldwide are by adolescent mothers.[1] In Brazil, this proportion is 18%, in spite of a decrease of 17% (114 761 fewer births) in 2015 compared with 2014.[2]

The strong association between low childhood socio-economic position and adolescent maternity has been well

documented,[3,4] including findings from the 1982 Pelotas Birth Cohort.[5] Low socio-economic position may contribute to adverse effects of adolescent pregnancy on offspring health,[6] and also to the association between young maternal age with lower offspring education, which was reported by a collaborative study with pooled data from five cohorts from low- and middle-income countries.[7]

The long-term socio-economic consequences of adolescent parenthood on the parents have been reported in cohorts from high-income countries.[8–11] Results have consistently shown that adolescent mothers are disadvantaged compared with other women, taking into account at least one of the following outcomes: educational attainment, employment opportunity, labour market experience, wage, and income. By contrast, in men, the effects of early paternity on education, employment, and income are inconsistent.[11–14]

These associations have been less investigated in low- and middle-income countries. In longitudinal studies conducted in South Africa, adolescent parenthood is clearly associated with poorer educational outcomes in early adulthood.[15–17] The evidence from Latin American countries is mainly from cross-sectional studies in women,[18–23] whereas, to our knowledge, no study has examined the potential socio-economic consequences of adolescent paternity in this setting.

Independent of the effect of lower socio-economic position on the early maternal age at first birth, we hypothesised that adolescent parenthood has adverse effects on attained education and income at age 30 years.

Methods

Study design and participants

Adolescent parenthood was investigated among women and men who were on average age 30 years, and who belonged to a birth cohort that was initiated in 1982. In that year, all hospitals in Pelotas, a city in Southern Brazil, were visited daily and women who gave birth were approached for interviews. All 5914 live births, representing 99.2% of all births, whose mothers lived in the urban area of Pelotas were included in a birth cohort study. This cohort was followed several times, the last follow up being carried out in 2012–2013 when the members were aged 30. Further details of the 1982 Pelotas Birth Cohort have been described elsewhere.[24–26] The Ethical Committee of the Federal University of Pelotas approved the study protocol. Verbal informed consent was obtained in the early phases of the study, and written consent in the more recent waves. The Wellcome Trust supported these recent waves, and a researcher grant was received from the Brazilian Coordination of Improvement of Higher Education Personnel (CAPES). As a population-based observational study, patients were not involved and a relevant core outcome set was not identified.

Variables

Age at birth of each cohort member's first child was extracted using a standard questionnaire for all women and men belonging to the 1982 birth cohort who attended a research clinic at age 30 years. Additionally, it was assessed at age 23 in all members and at age 19 in all women as part of a study of childbearing in adolescence.[5] Here, data on age at first birth were aggregated giving priority to positive responses from the earlier waves of data collection. Adolescent parenthood was defined as having a first live born child before age 20,[1] and the age at first birth was stratified as 11–15 or 16–19 years.

The outcomes considered here were collected at age 30 . Years of formal education successfully completed were extracted by questionnaire. Household income was calculated as the sum of the reported monthly incomes of all working persons who lived in the same household of the cohort member, including own income. The amount earned in the previous month was collected in *Real* (R$; in 2012, one Real corresponded to approximately US$2).

Pre-adolescent socio-economic variables, collected in previous waves of this cohort study, were considered as potential confounders. The interviewer rated maternal skin colour in the perinatal study, and participant's skin colour was self-reported in the follow up at age 23 years according to the categories proposed by the Brazilian Institute of Geography and Statistics. Skin colour used here aggregates both sources of information. 'Black' (*preto*) and 'mixed' (*pardo*) responses were re-categorised here as 'black or mixed'. Data on Asian and Indian individuals were excluded from this analysis, as they constituted only 3% of the sample at age 30 years. Household income in 1982 was collected in multiples of the minimum wage in five categories (<1.1, 1.1–3, 3.1–6, 6.1–10, >10), and the corresponding proportions of the sample in each category were 21.9, 47.4, 18.5, 6.5 and 5.7%, respectively. As information on income as a continuous variable was not collected in 1982, a principal components analysis (PCA) was carried out using four variables—delivery payment mode (out-of-pocket, public free or private health insurance) and mother's education, height, and skin colour, all of which were strongly related to socio-economic position. The first component was used to derive a score that was then used to rank individuals who were classified into tertiles of household groups.[27] Own parents' education was defined as the highest grade of education successfully completed, based on paternal education measured in 1984 and maternal education measured (twice) in 1982 and 1984 waves. A household assets index in childhood was based on the

ownership of household goods and was estimated using factor analysis.

Additional potential confounders measured in the perinatal follow up of the cohort were: own mother's age; maternal body mass index (pre-pregnancy weight was based on information from antenatal care records or—when not available—by recall; height was measured by the research team) expressed as weight in kilogrammes divided by height in square metres – kg/m^2); participant's gestational age at birth (in full weeks, based on the date of the last menstrual period); own mother's smoking during pregnancy (at least one cigarette a day in any part of pregnancy); own type of delivery (vaginal or caesarean delivery), and own birthweight in grammes (measured using calibrated paediatric scales). Duration of own breastfeeding was obtained in 1984 and 1986. As exclusive breastfeeding was rare, information on age at introduction of other foods was also used. We also considered as potential confounders, own duration of predominant breastfeeding in months, own age when water or teas were introduced, and breast milk, and age at menarche, which was collected in 1997 and 2001 for sub-samples, and in 2004–2005 for all. We used the information obtained, in the following order, ages 15, 19 or 23 years, when the first was not available. For cohort members who had a child, we calculated 'number of children' as all live births for each woman or man before age 30 years.

Statistical analysis

Descriptive data were summarised as proportions or means, and their respective confidence intervals, according to age at parenthood. Unadjusted trends and between-group differences were tested by linear trend chi-square and ANOVA. The effects of adolescent parenthood on outcomes at age 30 years were estimated through linear regression in:crude modelsmodels including possible pre-adolescent confounders: skin colour; household income in 1982; maternal education in 1982 and 1984; own father's education; own childhood asset index; own mother's age; own mother's pre-pregnancy body mass index (BMI); own mother's smoking; own gestational age; own type of delivery; own birthweight; own breastfeeding; age at menarche in womennumber of children by age 30 years, considered as a potential mediator. The potential modifying role of the number of children was also tested for the outcomes by introducing an interaction term.

To estimate the direct and indirect effects of the main exposure on the outcomes, we used G-computation.[28] The natural direct effect (NDE) represents the effect of the age at first birth on the outcome that is not captured by the mediator, whereas the natural indirect effect (NIE) considers the effect captured by the mediator, number of children. Considering the sum of NDE and NIE as the total effect, dividing NIE by the total effect represents the percentage of the effect that is captured by the mediator. In these analyses, socio-economic and biological variables collected during infancy and childhood were considered as base confounders, and those collected at age 23 years, post-confounders.

As income was not normally distributed, log-transformed variables were included in the linear regression models. The resulting beta values represent symmetrical percentage differences in the adolescent parenthood groups compared with those without adolescent parenthood.[29]

Results

In all, 3701 members of the 1982 Pelotas Birth Cohort were interviewed in 2012–2013, representing a follow-up rate of 68.1% (including 325 cohort members known to have died). Women were more likely than men to have had a child: 64% of women and 50% of men were parents at age 30 years. These differences are even greater for adolescent parenthood (before age 20), which was reported by one in four women compared with less than one in ten men. Although the follow-up rate in 2012–2013 was slightly higher in women than men,[26] there was no difference in the frequency of adolescent parenthood for women and men (respectively, 27.7 and 9.9% in 2012–2013) when comparing the current sample with those interviewed at age 23 years (28.4% for women and 10.9% for men in 2004–2005; *P*-values 0.49 and 0.10, respectively).

Age at first parenthood

Inverse associations were observed between age at first parenthood and all pre-adolescent socio-economic variables, and adolescent parenthood was more frequent among black or mixed subjects and in those from families in a lower socio-economic position (Tables S1 and S2). Adolescent parenthood was also more frequent among women and men who were themselves born to an adolescent mother.

Educational attainment, household income, and own income at age 30 years are summarised by age at first parenthood in Table 1. Some information was missing for outcomes at age 30 years, mainly for household income, with 6.6% missing for women and 5.3% for men. Income variables did not follow a normal distribution, and 686 (18.7%) cohort members did not have any own income. Therefore household income was considered to be the co-primary outcome, along with years of education. The highest mean values of both outcomes were observed among cohort members without children at age 30 years, and the lowest values were observed among members who had been adolescent parents. There were strong positive associations of age at first parenthood with years of education and household income (Table 1). For participant's own income,

Table 1. Means and confidence interval (95% CI) of educational attainment and income at age 30 according to age at maternity and paternity. Pelotas, Brazil, 1982–2012

Age at birth of first child (years)	Education (years)	Income (R$*)	
	Mean (95% CI)	Household Mean (95% CI)	Own Mean (95% CI)
Women*	***n* = 1853; *P* < 0.001**	***n* = 1759; *P* < 0.001**	***n* = 1367; *P* < 0.001**
11–15	7.4 (6.5–8.4)	1456 (1165–1747)	540 (416–664)
16–19	9.0 (8.7–9.4)	2099 (1843–2355)	643 (549–737)
20–30	11.4 (11.2–11.7)	2891 (2599–3184)	917 (794–1041)
No child	14.3 (14.0–14.5)	4345 (4012–4677)	1725 (1564–1887)
Men*	***n* = 1752; *P* < 0.001**	***n* = 1694; *P* < 0.001**	***n* = 1592; *P* = 0.52**
11–15	7.8 (6.3–9.3)	2805 (1687–3924)	2221 (1169–3273)
16–19	8.8 (8.3–9.3)	2706 (2357–3056)	1752 (1473–2031)
20–30	10.0 (9.8–10.3)	3288 (2957–3620)	2100 (1885–2314)
No child	12.0 (11.7–12.3)	4073 (3711–4435)	2101 (1904–2297)

*R$ – *Real* (corresponded to approximately US$2 in 2012); monthly income.

a relation with age at first birth was observed in women but not men.

Adolescent parenthood and educational attainment

In women, the association between adolescent parenthood and education remained after adjusting for potential confounders (skin colour; own parents' income in 1982; own mother's education in 1982 and 1984; own father's education; own parents' asset index; own mother's age; own mother's pre-pregnancy BMI; own mother's smoking; own gestational age; own type of delivery; own birthweight; own breastfeeding; and own age at menarche). Mothers with adolescent parenthood at ages 11–15 had on average 4.4 years (95% CI −5.5 to −3.3) less education compared with women who had not experienced adolescent parenthood. In addition, women who were 16–19 years at first birth had on average 2.8 years (95% CI −3.2 to −2.3) less education (Table 2). A significant interaction was observed between age at first birth and number of children ($P = 0.04$). The detrimental effect of having three or more children had a greater detrimental effect on attained education at age 30 years among those women who reported adolescent parenthood (Figure 1).

Among men, adverse effects of adolescent parenthood on education were also found, but these were smaller than those found in women (Table 2). Fathers had on average 2.4 (95% CI −5.0 to −0.2) or 1.3 (95% CI −2.0 to −0.6) years less education, respectively, if they had their first child at age 11–15 or 16–19, as compared with men without adolescent parenthood. There was no interaction with number of children ($P = 0.86$).

Adolescent parenthood and income

In adjusted models, women who had a child at ages 11–15 or 16–19 had a 49 or 33%, respectively, lower income compared with those without adolescent parenthood. Similar findings were seen for participant's own income (Table S3). By contrast, in men, a modest crude adverse effect of adolescent parenthood on the household income was attenuated on adjustment for potential confounders (Table 2).

Number of children as mediator

Direct and indirect effects of adolescent parenthood on education and income, considering the number of children at age 30 as a mediator, are presented in Table 3. Number of children explained 57% of the estimated effect of adolescent parenthood on educational attainment among women and 44% among men. Number of children also explained 38% of the association between adolescent parenthood and income among women.

Discussion

Main findings

The findings here indicate likely adverse effects of adolescent parenthood on education later in life in a prospective cohort followed since birth in a Southern city in Brazil.

Table 2. Estimated effect of adolescent parenthood on educational attainment and income at age 30. Pelotas, Brazil, 1982–2012

Age at birth of first child in adolescence (years)	Education (years)		Income (R$)	
	Crude	Adjusted**	Crude	Adjusted**
Women	***n* = 1853**	***n* = 1059**	***n* = 1759**	***n* = 1014**
11–15	−5.42 (−6.30 to −4.53)	−4.44 (−5.53 to −3.34)	−0.77 (−0.99 to −0.56)	−0.49 (−0.79 to −0.20)
16–19	−3.85 (−4.27 to −3.44)	−2.75 (−3.23 to −2.27)	−0.52 (−0.61 to −0.42)	−0.33 (−0.46 to −0.21)
P value	<0.001	<0.001	<0.001	<0.001
R^2	0.19	0.40	0.07	0.24
Men	***n* = 1752**	***n* = 1074**	***n* = 1694**	***n* = 1041**
11–15	−3.34 (−5.92 to −0.76)	−2.39 (−5.00 to 0.21)	−0.02 (−0.56 to 0.51)	0.35 (−0.26 to 0.97)
16–19	−2.37 (−3.00 to −1.73)	−1.29 (−2.01 to −0.56)	−0.17 (−0.31 to −0.04)	0.02 (−0.15 to 0.19)
P-value	<0.001	<0.001	0.04	0.52
R^2	0.03	0.33	0.00	0.20

*Reference group: women or men who had child at 20–30 years of age or with no child.
**Adjusted for skin colour; household income in 1982; maternal schooling in 1982 and 1984; paternal schooling; asset index; maternal age; prepregnancy BMI; maternal smoking; gestational age; type of delivery; birthweight; breastfeeding and menarche (for women).

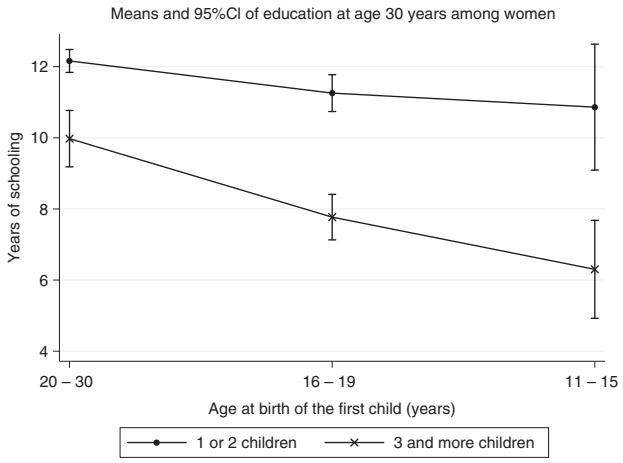

Figure 1. Adjusted means of education according to age at birth of the first child and number of children among women.

Although the adverse effect of adolescent parenthood on household income was also observed among women, we found no effect of adolescent paternity on income at age 30 years, and the apparent adverse impact of adolescent parenthood on education was smaller in men than in women. In addition, the number of children modified the effect of age at birth of the first child on education at age 30 years, among women.

Strengths and limitations

To our knowledge, this is the first cohort study from a Latin American country that has addressed the effects of adolescent parenthood on socio-economic variables later in life. In addition, early paternity was not considered in studies conducted in these countries. However, some limitations must be considered. Although socio-economic background, and biological characteristics from the children and their mothers, including maternal age when the

Table 3. Estimated direct and indirect effects of adolescent parenthood on educational attainment and income at age 30 years mediated through number of children. Pelotas, Southern Brazil, 1982–2012

Effect of adolescent parenthood	Total effect (95% CI)	Direct effect (95% CI)	Indirect effect (95% CI)*
Education			
Women	−2.26 (−2.73 to −1.79)	−0.98 (−1.46 to −0.50)	−1.28 (−1.65 to −0.90)
Men	−0.26 (−0.38 to −0.13)	−0.16 (−0.30 to −0.03)	−0.10 (−0.18 to −0.01)
Income			
Women	−1.23 (−1.81 to −0.66)	−0.69 (−1.29 to −0.10)	−0.54 (−0.95 to −0.13)
Men	0.10 (−0.04 to 0.24)	0.12 (−0.03 to 0.27)	−0.02 (−0.11 to 0.07)

*Mediated by number of children.

cohort member was born, were considered important confounders, some unmeasured variables during infancy or childhood such as intelligence quotient may have been relevant and residual confounding should not be excluded. Besides the number of children, the impact of other potential mediators such as social and familiar support was not considered in this analysis. Information about miscarriage or abortion was unavailable for this cohort, and there was not enough data to compare sisters who had or had not had a child during adolescence in order to perform within-family analyses. However, early childbearing may also have important adverse consequences for the other family members that could not be adequately addressed in studies including this comparison group. In addition, studies comparing women who had a child during adolescence with those who had a miscarriage or abortion, when conducted in countries where abortion is illegal, as in Brazil, may result in overestimated adverse effects of bearing a child, taking into account that adolescents who had an abortion are likely to come from more favoured backgrounds.

Taking into account the well-established associations of low socio-economic position, maternal age at the participant's birth, and age at menarche with adolescent parenthood, our analyses were controlled for socio-economic background and biological characteristics measured prospectively in this birth cohort study. In addition, we hypothesised that there might be a possible interaction between the effect of adolescent parenthood and the number of children. This last variable may be considered a possible mechanism to explain the effects of adolescent parenthood on human capital later in life, but has not always been considered in the previous studies. Among women, we found an interaction between adolescent parenthood and number of children, and the effects on socio-economic position were mediated for number of children. However, this variable has not been considered as a mediator in the previous studies, even those showing that adolescent mothers and fathers had more children compared with those who were parents at a later age.[9]

Interpretation

Our findings are consistent with evidence from cohort studies from high-income countries.[9–11,13] Men and women who graduated from Wisconsin (USA) high schools in 1957 were followed up to age 50; adolescents who were parents completed less education and had less prestigious jobs compared with other participants in analyses adjusted for parents' socio-economic status and the respondent's intelligence quotient.[9]

The disadvantages of early paternity on socio-economic outcomes later in life have been shown in most cohort studies in which adolescent paternity has been studied,[8,9,12–14,30] except in one from a socially disadvantaged community in Chicago (USA).[11]

In Latin America, the potential impact of adolescent motherhood on socio-economic outcomes later in life has been investigated previously in cross-sectional but not prospective studies.[18,20–23] A cross-sectional survey conducted in Mexico,[21] including adults aged between 25 and 64 years, reported adverse effects of adolescent maternity on education in both short-term and long-term analysis models, as well as on household income, consistent with our findings. However, when making inferences regarding the causal effects of adolescent parenting, the strong possibility of potential confounding by factors that make adolescents susceptible to early sexual behaviours and pregnancy needs to be considered. Another cross-sectional study, also conducted in Mexico, therefore chose as the comparator group, women who reported an adolescent miscarriage; that study found a converse positive effect of adolescent maternity on education, employment, and income.[20]

The impact of very early maternity (adolescents who had a child between the ages of 13 and 15 years) on socio-economic outcomes was also studied in Chile using a propensity score matching methodology to compare women aged 24 years who had several similar characteristics, except for their adolescent mother status. Although a stronger adverse effect was also observed on education, the impact on own income by age 24 years found in Chilean women living in non-poor households was not different regardless of whether maternity occurred in early or later adolescence.[23] By contrast, our study design allowed for prospective measurement of detailed information on pre-adolescent socio-demographic factors, which were controlled for in the analysis models.

Conclusion

Our results, in a middle-income setting, contribute to evidence for the adverse consequences of adolescent parenthood on the socio-economic outcomes later in life; these were mainly on educational attainment and had larger effects in women than in men. Consequently, these findings have social and economic implications throughout adulthood and for the next generations. Beyond the impact on intergenerational inequities, these findings have important policy implications. In Brazil, there was an expansion of the number of schools between 1996 and 2009, as well as a decline in teenage childbearing.[31] The national conditional cash transfer programme increased school attendance among teenagers, mainly from rural areas,[32] and decreased fertility rates among eligible girls from urban areas, within 5 years of programme implementation.[33] Data from the US National Longitudinal Survey of Youth suggest that women who completed their education after the transition to

maternity and mothers who pursued schooling were more disadvantaged, more often poor, younger, and had greater job instability, although they had higher cognitive test scores.[34] As a marker of social and economic disadvantage, childbearing in adolescence can be a cause of further disadvantage and health problems. Programmes should be a priority in public policies to prevent adolescent pregnancies and to support young mothers to help them achieve a better education, employment, and economic opportunities throughout their life and for the next generation. Such policies would have both health and socio-economic benefits.

Disclosure of interests

None declared. Completed disclosure of interest forms are available to view online as supporting information.

Contribution to authorship

Conceptualisation and design of the work: DPG, BLH, FCB, KKO. Acquisition of data for the work: DPG, GVAF, NPL, JVSM, HG, BLH, FCB. Analysis and interpretation: DPG, GVAF, ELR, BLH, KKO. Writing, revising, and editing: DPG, KKO. All authors approved the version to be published.

Details of ethics approval

The Ethical Committee of the Medicine Faculty from Federal University of Pelotas approved the study protocol (number 16/12) on 8 March 2012. Verbal informed consent was obtained in the early phases of the study, and written consent was obtained in the more recent waves.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Socio-demographic characteristics according to maternity among women from 1982 Pelotas Birth Cohort. Pelotas, Southern Brazil, 1982–2012

Table S2. Socio-demographic characteristics according to paternity among men from 1982 Pelotas Birth Cohort. Pelotas, Southern Brazil, 1982–2012

Table S3. Effect of adolescent parenthood on own income at age 30 years. Pelotas, Southern Brazil, 1982–2012 ■

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