

Outcomes for children born to teen mothers in South Africa

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“We want to end this so that we can be a nation that has values. If we are a serious nation, we must take hard decisions. Nobody will help us but ourselves.”

-Jacob Zuma on teenage pregnancy (Hartley, 2008)

1. Introduction

Between 1996 and 2001, fertility rates declined in South Africa. With an estimated fertility rate of 2.8 children per African women, South Africa has the lowest fertility levels in sub-Saharan Africa. Yet, while fertility rates have declined for the teenage group (aged 15-19), the rate of teenage childbearing is high by world standards, especially for coloured¹ and African girls. 7% of African teenage girls between the ages of 15 and 19 give birth each year. This constitutes 16 % of births to African women of childbearing age. The proportion of births to coloured teenage mothers is lower at around 14.8%, but this percentage shows an increase between 1996 and 2001 of 0.8% while the African percentage has remained stable (Dorrington & Moultrie, 2004). Thus children born to teenage mothers comprise a large and growing proportion of society.

Teenage childbearing is generally considered a social problem with costs to the teenage mother, her child and society at large. This is reflected in the quote above made by Jacob Zuma, president of the African National Congress (ANC), during an election rally. The statement was accompanied by claims that teenagers who have children are burdening South African society by exploiting social grants and forcing their relatives to care for their children (Weaver, 2008). There is little research in South Africa to back these claims. In addition, research into the outcomes for children born to teenage mothers in South Africa is (to our knowledge) non-existent. The international literature finds mixed results as to the direction and size of the effect of being born to a teen mother and is plagued by data limitations and identification issues. This paper estimates the consequences of being born to a teen mother in Cape Town, South Africa.

2. Early childbearing and child/young adult outcomes

2.1 The causal/correlation debate

Research into the social and economic outcomes of teenage mothers is widespread in the international literature (Hoffman et al, 1993 for a review of the literature up until 1998, Holmlund, 2005). Much less research or debate is found on the intergenerational effects of teenage childbearing (Francesconi, 2008). There are many channels through which a negative relationship between socio-economic outcomes and being the child of a teenage mother could develop. Consensus over the existence and magnitude of a causal link between being born to a teenage mother and poorer outcomes in life is however, not found in the literature.

Early fertility could limit a mother's options to further her education and/or reduce her prospects in the labour market, both leading to fewer resources for her child. Another plausible channel through which early childbearing may have a negative effect on the child is that the mother is less likely to be in a stable or existent relationship. Thus children of teen mothers are less likely to grow up with both their biological

¹ The apartheid system classified the population into four population groups, namely African, coloured, Asian and white. This classification was used to differentiate the rights and opportunities of each group. All blacks were discriminated against but Africans, representing over 80% of the South African population, had the most severe discrimination, with Asian and coloureds having greater rights and opportunities than Africans but fewer than whites.

parents. This has both an economic and psychological impact. Single parents generally have single incomes. Added to this, children of teen mothers will very likely be raised by a father figure with no biological ties to them, having possible emotional and psychological impacts. Another argument given is that a teen mother's social skills might be underdeveloped resulting in poor parenting (Levine et al 2007).

The problem is how to disentangle whether the poorer outcome is a result of the early timing of the birth or a consequence of other existing social and economic disadvantages; in other words whether the relationship between the early birth and the child's outcome is causal or due to selection. Teenage mothers are disproportionately more likely to come from poorer communities in which children face fewer resources and more constraints whether born to teenage mothers or not. These restrictions result in poorer social and economic outcomes. This paper deals with these complicated pathways by attempting to answer a specific question; namely, whether the same child, if born to the same mother at a later age would fare better on the measured outcomes.

Table 1 in the appendix presents a summary of some of the literature on the outcomes of children born to teen mothers. Correlation between early childbearing and poorer child outcomes is not disputed in the literature; the relationship is significant and the negative effects generally large. However, consensus over whether this relationship is causal is not found. Levine et al (2007) point out that the inconsistencies in the literature arise from two main sources. First, different data and methods are used, some more effective in controlling for unmeasured background characteristics, i.e. selection, than others. For example, Geronimus et al (1994) argue that if current maternal and household characteristics are used as controls, this may measure the consequences of the early birth and not reflect pre-birth conditions. Since inclusion of current SES controls generally decrease the size and significance of the teen mother affects it is unclear whether this should be interpreted as there being little effect between early childbearing and child outcomes or whether it signals that the effect is indirect, i.e. that teen childbearing lowers current SES and hence adversely affects child development (ibid). Thus controls should rather reflect pre-birth conditions. Second, the causal pathways through which teen mothering affects child outcomes are likely to differ across outcomes. Since different researchers have chosen different outcomes, some have found significant negative (some positive) effects and others none.

2.2 Outcomes, controlling for selection

The predominant approach in the existing literature to control (or attempt to control) for pre-birth socioeconomic status is cousin fixed-effects estimation (Geronimus et al 1994, Levine et al 2001, Turley 2003). Young adults born to teen mothers are compared to cousins born to their mothers' sisters. Since the mothers of cousins are more likely to share similar characteristics than a random sample of mothers, to some extent this specification controls for unobserved household, family and mother characteristics which are common across both individuals in a comparison pair. In a slightly different variation, Francesconi (2008) uses fixed effects but looks for differences between children of the same mother (siblings fixed effects) and Levine et al (2007) uses a combined sibling/cousin fixed effects model. The only other approach, applied by Levine et al (2007), is an instrumental variable approach using miscarriage as a natural experiment to instrument for having a teen birth.

Levine et al (2007), Geronimus et al (1994) and Turley (2003) all agree that the correlations found in simple multivariate analyses between having a teen mother and a child's outcomes reflect selection of these children into families with a higher propensity to fare worse, and do not realistically reflect the effect of early

childbearing per se. This is illustrated through the reduction of the teen mother coefficient's size and significance once mother and household unobservable characteristics are controlled for.

Besides some negative effects on economic outcomes (economic inactivity, lower probability of being in the highest income decile and a higher probability of being in the bottom earnings decile) found by Francesconi (2008), the literature which controls for unobservable characteristics only finds significant negative effects for behavioural outcomes of youth. No similar negative behavioural outcomes are found for young children (Geronimus et al 1994 and Turley 2003). Levine et al (2001 & 2007) find higher probability of sex before 17, fighting, truancy and grade repetition (which they argue constitutes both an academic and behavioural outcome) and Grogger (1997) finds that male incarceration rates are higher for children of teenage mothers. The fact that Geronimus et al (1994) and Turley (2003) did not find any significant effects for similar behavioural outcomes among young children might "indicate that the effects of teen parenting are slow to emerge in children" (Levine, Emery, & Pollack, 2007, p. 116).

Besides Levine et al's (2007) finding on grade repetition, no negative impact is found for educational, psychological or infant health outcomes. In fact, Geronimus and Korenman (1993) find a few positive infant health outcomes for children born to teenage mothers.

2.3 Channels

Little research has been done on the channels within the family which potentially exacerbate or mitigate the negative outcomes for children born to teen mothers. Francesconi (2008) finds that growing up in a non-intact family magnifies the adverse affects of having a teenage mother on many of the young adult outcomes. He finds little evidence of a similar magnifying effect of child poverty. This focus on non-intact families is useful in highlighting a common weakness in most of the literature in this area; namely that the debate over the impact of teen childbearing on the child is concentrated to a developed world, nuclear family context. This is unlikely to be appropriate in the South African context. Indeed, this context seems to differ in a number of key ways. First, the channels through which early childbearing are argued to negatively affect young adult outcomes do not necessarily exist in the South African context. South African law allows girls to return to school after giving birth and Kaufman et al (2001) find that many teen mothers do return to school to complete their education. Second, South African research shows that the family structure into which the child is born is fundamental in determining whether the teen mother continues and completes her education (Marteleto et al, 2008, Kaufman et al, 2001 and Madhavan & Thomas, 2005). Related, the absence of a biological father in a child's household is not uncommon or isolated to children born to teen mothers. In addition, the presence of a biological father has not been found to significantly affect the educational attainment of children in rural areas (Townsend et al, 2002).

Finally, South Africa is a country where many families have social networks to support and care for their children that are not based on the nuclear family but are more likely to be multigenerational. These structures play an important role in the upbringing and care of children. This increases the likelihood that the child will be cared for by an experienced adult. The child might actually have more financial, experience and time resources than would be expected. The teen mother may also have gained childcare experience by growing up in a multigenerational household where exposure to childcare is a daily event. Geronimus (2003) points out that the concept of early childbearing as a social problem comes from societies in which nuclear family structures are predominant. She argues that delaying childbearing in societies which experience different environments, resources and constraints to those common to nuclear family orientated societies, does not necessarily represent optimal behaviour.

2.4 A definitional and a technical consideration

Turley (2003) highlights another important cause of inconsistency in the literature which lies in the testing of different hypotheses. Children born to teen mothers might fare worse than children born to older mothers due to maternal immaturity or because women who give birth in their teens are systematically different from older mothers. When mothers' age at each birth is used in the analysis, this implicitly tests the first hypothesis, what Turley (2003) calls the 'maternal maturity' hypothesis. This is most common in the literature. However, Turley (2003) and Geronimus et al (1994) use age at first birth for each child and hence test the second hypothesis, Turley's (2003) 'systematic difference' hypotheses. Under this hypothesis each child born to a woman who gave birth in her teens would be affected. We test the first hypothesis; whether being born to a teen mother affects young adult outcomes and check the sensitivity of these results to a test of the second hypothesis.

Finally, due to the high correlation between being born to a teen mother and being the first born, it is important that the effect of birth order on the measured outcomes be assessed or controlled for. Due to data availability and methods used the effectiveness of birth order controls varies within the literature. The simplest approach is to include birth order dummy variables (Geronimus et al 1994, Grogger 1997 & Levine et al 2007). A more thorough approach is to restrict the sample to first born children only, thus stripping out the potential bias of birth order completely (Geronimus et al 1994, Moore & Snyder 1991 & Turley 2003). Finally when assessing the 'systematic difference' hypothesis discussed above, Turley (2003) restricts the sample to non-first born children.

This paper contributes to the existing literature on outcomes for children born to teenage mothers' in three ways. First, it extends the literature to the South African context. The existing (limited) South African literature focuses on timing of births (Garrene et al, 2000) and the social and economic outcomes of the teenage mother herself (Marteleto et al 2008, Kaufman et al 2001 & Bledsoe & Cohen 1993) without assessing the direct impact of early childbearing on the child's outcomes. We use the Cape Area Panel Study (CAPS) a longitudinal study of adolescents and young adults in metropolitan Cape Town. These data meet the requirements for a siblings fixed effects model (allowing us to control for unmeasured maternal and household characteristics) and have the additional advantage of reflecting a contemporary view² of an urban area in a developing country.

The second contribution of this paper is to assess whether living arrangements during childhood are a channel through which being born to a teen mother effects young adult outcomes. We use variables which measure the proportion of the young adults' childhood spent living with their mother, father and maternal grandparent(s) and assess whether children born to teen mothers are protected or disadvantaged by living a greater proportion of their childhood with their mother, father and maternal grandparent(s).

Strong differences are found between population groups. For the coloured sample, in accordance with the international literature we find strong correlations between negative outcomes and being born to a teen mother. These effects are significantly reduced once socio economic status and other unobservable characteristics of the mother and household are controlled for. In the African sample we find very little

²Respondents of the CAPS were aged 14-22 in 2002. Thus we assess outcomes for children of teen mothers in the twenty first century unlike most of the other literature which uses data from pre 2000.

correlation between being born to a teen mother and young adult educational and home environment outcomes. In fact, we find some weak correlations between better outcomes and being born to a teen. Controlling for SES and unobservable characteristics has little effect for the African sample.

Some evidence is found in support of childhood living arrangements being a mechanism through which the effect of being born to a teen works. Children born to teens spend less of their childhood living with their mothers and fathers. For the African sample, living with their mother is protective of worse educational and home environment outcomes. For the coloured sample, living with their father is protective against worse outcomes. Since children born to teens are less likely to live with both parents than children born to older mothers, this means that less time spent with parents is a negative channel through which the outcomes of children born to teen mothers are affected. Children born to teen mothers are more likely to live with their maternal grandparents. Living with a maternal grandparent is found to protect coloured young adults born to teens from dropping out of school, not completing high school and physical abuse during childhood.

The rest of the paper is organized as follows. Section 3 briefly describes the CAPS data, the sample used in this analysis and the outcome and control variables. Section 4 discusses the mean parental, household and living arrangement differences between children born to teen versus older mothers. Sections 4.2 and 4.3 present our estimations of the causal impact of teen childbearing on young adult outcomes and discusses potential threats to the validity of the results. Section 4.4 investigates whether childhood living arrangements mitigate or exaggerate the teen mother effect. Section 5 concludes.

3. Data, Sample and Variables

3.1 The CAPS data

The first wave of the CAPS, collected in 2002, included 4,752 young people aged 14-22. Details about the CAPS, a collaborative project of the University of Cape Town, the University of Michigan and Princeton University, are available in Lam et al (2008).³

A young adult (YA) questionnaire was administered to up to three residents aged 14-22 in each sampled household, covering a wide range of issues including schooling, employment, fertility and childhood home environment. The questionnaire also included a life history calendar (Wave 1 calendar) that recorded residential movements, marriage and partnerships, pregnancies, schooling outcomes, employment and whether the young adult lived with their mother, father, maternal and paternal grandparents every year since birth. The first wave also included a self-administered written literacy and numeracy evaluation. The test took 20 minutes to complete and was available in English or Afrikaans, the two official languages of instruction in all secondary schools. The vast majority (99%) of Xhosa speaking respondents chose to take the test in English. In comparing the results it should therefore be borne in mind that coloured and white young adults completed the test in their first language, while Africans took the test in a second language.

Youth respondents were interviewed a second time in either 2003 or 2004 (Wave 2), a third time in 2005 (Wave 3) and a fourth time in 2006 (Wave 4). From Wave 2 onwards information on schooling, residential moves and employment were asked in a format that updated information from the month of the young adults' last completed interview. Thus information on these variables is available for each age until the age at which the young adult was last seen. The CAPS Waves 1, 3 and 4 included a household questionnaire

³ Additional detail and technical documentation are available on the CAPS web site, www.caps.uct.ac.za.

providing data on all household members and details on the relationship of each household member to the young adult. A household roster was also included in the young adult questionnaire for Wave 2.

Information on the age of the YA's mother is available from a combination of the Wave 1 household and young adult questionnaires for all mothers who were alive in 2002. From these two sources we have information on mothers' age for 88% of all young adults. The CAPS data thus offers a unique opportunity to explore whether mother's age at birth affects young adult outcomes for people living in Cape Town.

3.2 Analytical sample

The YA sample includes all young adults with information on their mothers' age and represents 88.11% (3662/4156) of the un-weighted⁴ CAPS sample of African and coloured⁵ youth in Cape Town in 2002.

A YA's mother's age can be missing for two reasons. First, if the mother was dead at the time of the interview the mother's year of birth was not asked. Deceased mothers contribute to 58.50% (289/494)⁶ of the sample with missing mothers' information. Second, a mother's information can be missing because the YA or person responding to the household questionnaire did not have information about the mother's age. If the mother was resident in the YA's household at the time of the interview, the mother's age was asked in the household questionnaire; if the mother was not resident it was asked in the YA question. Table 1 presents the break down for missing mother's ages for Wave 1, 3 and 4 by the different categories and population groups.

Table 1.
Reason for missing mother's age by population group in each wave

	Coloureds			Africans		
	Wave 1	Wave 3	Wave 4	Wave 1	Wave 3	Wave 4
Resident, YA is not the household respondent	1.19	0	2.78	2.27	4.8	3.48
Resident, YA is the household respondent	0.74	1.41	0	1.72	3.23	1.79
Deceased	65.94	69.59	67.68	49.45	59.45	58.14
Vital status unknown	3.56	0.76	3.51	1.48	0.83	2.34
Non-resident, unknown age	28.56	28.24	26.03	45.08	31.69	34.25
Total number of missing mothers age	227	164	153	264	152	160
% missing mothers age	7.5	5.57	4.95	16.47	9.69	9.78

Notes to table 1: Numbers and proportions presented are weighted to account for the CAPS sample design but do not adjust for attrition across waves.

Differences are seen between the coloured and African population groups. African young adults are more than twice as likely to have missing mother information (16.5% versus 7.5%) in 2002 (Wave 1). In addition, while in each wave the majority of missing mother's ages is a result of the mother being deceased for both population groups, Africans have almost an equal portion missing because their mother was non-resident and the young adult was unaware of her age to the amount missing because the mother is deceased. Besides the deceased mothers, most other missing ages are for mothers that are not resident in the YA's household for both population groups. To account for potential systematic differences in the measured outcomes of young

⁴ 89.36% of the weighted sample of Africans and coloured young adults

⁵ Since the frequency of white respondents born to teen mother's is very low

⁶ 57% of the weighted sample of African and coloured young adults

adults with missing mother's age where the mother is not reported to be deceased⁷, we included an indicator that the young adults' mother's age is missing in all analyses. This indicator makes some difference to the coefficient on the teen mother variable in the African analyses, but has little effect for coloured analysis.

In our analysis one of the methods we use to control for unobserved characteristics of the mother and household is sibling/cousin fixed-effects estimation, hence the number of sibling/cousin pairs is of importance. Table 2 presents the distribution of individuals and comparison pairs across households for the YA. Due to the CAPS sample design, a maximum of three YA sibling/cousin pairs are found in each household. The majority of households have one YA in the household, but there are over 400 households with multiple YA's resident for both population groups. Of these, 100 coloured and 121 African households have variation on the teen mother indicator, representing 7% and 8% of all coloured and African households in the sample respectively. Variation on the teen mother variable means that at least one YA in the pair (trip) was born to a teen mother and at least one was born to an older mother.

Table 2.
The sample: number of households, young adults and households with variation on the teen mother variable

Coloured sample				African sample		
# of young adults per household	# of households	# of young adults	# of households with variation on teen mother variable	# of households	# of young adults	# of households with variation on teen mother variable
1	922	922		891	891	
2	398	796	78	394	788	74
3	96	287	22	157	472	47
Total	1416	2005	100	1442	2151	121

Notes to table 2: Variation on the teen mother variable requires that at least one young adult in the household be born to a teen mother and at least one not born to a teen mother.

3.3 Analysis Variables:

Early childbearing has been shown to have a heterogeneous affect on child and young adult outcomes. We restrict our analysis to educational and childhood home environmental outcomes for young adults.

To study academic proficiency, age-standardised scores from the numeracy test taken in 2002, grade progression rate between age 9 and 18, the probability of dropping out of school by age 16 prior to completing grade 12 and successful completion of grade 12 (high school) by age 20, are examined.

While all the educational measures are clearly linked they are likely to measure slightly different effects of being born to a teen mother. The age-standardised mathematics score could be seen to represent a combination of ability and the quality of education the young adult received up to 2002, as well as the age

⁷ Young adults with deceased mothers are excluded to avoid introducing orphanhood bias. Ardington (2008) finds orphans are at risk of worse education outcomes and we do not want this to interfere with our attempt to elicit the effect of being born to a teen mother.

they started school. The improvement rate strips out differences such as what age the child starts school and looks purely at the child's progression through grades. The dropout variable likely measures a combination of academic proficiency, behavioural characteristics and external demands on the child. Levine et al (2007) note that grade repetition reflects both academic skill and behavioural issues. We would argue the same is true for dropping out of school without completing high school. On the other hand, the pressure could also come from the young adults' home. A young adult might be forced to drop out of school to support their family or care for a household member. Finally, the high school completion variable measures, besides other things, the young adults future possibility of tertiary study and hence probability of employment and future salary levels.

We also include two measures of adverse family/home environment in the child's formative years (the YA's first 14 years of life). These are indicators of frequent (often or very often) exposure to fear of physical harm and the presence of an alcoholic in the young adult's childhood household.

Some outcome measures are best defined by success/failure by a specific age. The likelihood of an event occurring increases with age, due to increased exposure. Thus to allow equal exposure to YA's of all ages in our sample, we restrict the age by which the event may occur.

Table 3 shows sample sizes and attrition rates for the sample seen by ages 16, 18 and 20. Outcome variables which are restricted to these sub-samples are included in the final column. The design of the CAPS questionnaires allowed Waves 2 through 4 to collect information on a range of outcomes such as schooling relative to when the young adult was last interviewed. Thus while respondents were aged 14-22 in 2002, the questionnaire design together with the life history calendar collected in Wave 1, results in better response rates for outcomes defined by age.

There is a clear relationship between age and attrition. Outcomes constructed based on an event by age 16, only exclude 1% of the sample while measures that are restricted to respondents seen over the age of 19, result in attrition of 10%. In addition, there are differences in response rates between the African and coloured sampled. Attrition is higher for Africans at each age, a function largely of the higher rates of migration of Africans from Cape Town to the Eastern Cape.

Table 3.
Sample size, potential sample size and implied attrition rate at age 16, 18 and 20

	Sample size				Potential sample				Rate of attrition				Conditional Variables
	African	Coloured	Total	Teen Mother	African	Coloured	Total	Teen Mother	African	Coloured	Total	Teen Mother	
Age at 1 January													
16	1742	1823	3565	530	1779	1842	3621	535	2%	1%	2%	1%	Dropped out
18	1563	1628	3191	472	1642	1687	3329	492	5%	3%	4%	4%	Grade progression rate
20	1138	1149	2287	357	1261	1237	2498	391	10%	7%	8%	9%	Completed high school (grade 12)

Notes to table 3: The retrospective calendar in wave 1 in addition to the updating approach used to collect ongoing information in the CAPS data, enables calculation of schooling outcomes at a specific age on samples larger than the sample which would include only young adults who responded to these questions at the specified age.

Table 4.
Table of means: parent and household characteristics by teenage mother classification

	All young adults	Young adults born to teenage mothers	All young adults	Young adults born to teenage mothers
	Coloureds		Africans	
Control Variables:				
Indicator: Born to mother at age below 20	0.142		0.149	
Mothers age a birth of young adult	25.854	17.905***	26.848	17.256***
Mothers age in 2002	43.535	35.799***	44.837	35.459***
Fathers age in 2002†	45.81	39.576***	50.296	41.673***
Age of young adult	17.681	17.894	17.989	18.204*
Young adult is male	0.462	0.451	0.424	0.396
Childhood household and parent characteristics:				
Mother's education	8.484	8.346	7.935	9.325***
Father's education	8.865	8.516	7.113	8.824***
Indicator: household characterised as poor during young adult's childhood	0.045	0.032	0.265	0.269
Living arrangements: proportion of first 14 years live with:				
Mother	0.917	0.82***	0.822	0.761***
Father	0.658	0.452***	0.493	0.343***
Maternal grandparent(s)	0.18	0.335***	0.229	0.395***
Paternal grandparent(s)	0.048	0.063	0.059	0.072
Household characteristics in 2002:				
Household size	7.067	7.909***	7.601	8.033
Number of children under 14	1.356	1.848***	1.428	1.596**
Indicator: pensioner in household	0.161	0.17	0.117	0.148
Number of unemployed adults	0.915	0.833	1.62	1.504*
Indicator: household have internal piped water	0.922	0.894	0.315	0.327
Indicator: household has a flush toilet	0.965	0.932**	0.811	0.851
Number of assets (max 12)	7.44	6.894***	3.92	4.311**
Indicator: poor household (self classified)	0.184	0.253**	0.579	0.593
Per capita household income	R 1,012.01	R 720.519***	R 394.99	R 365.126
Number of observations	1854	264	1808	270
Number of households	1335	172	1246	173

Notes to Table 4: Weighted means are presented. Significance shown is for differences between the mean for children born to a teen versus an older mother and is represented by * <0.1, **<0.05 and ***<0.01.

† 43% of the African sample and 26% of the Coloured sample have missing father's age in 2002

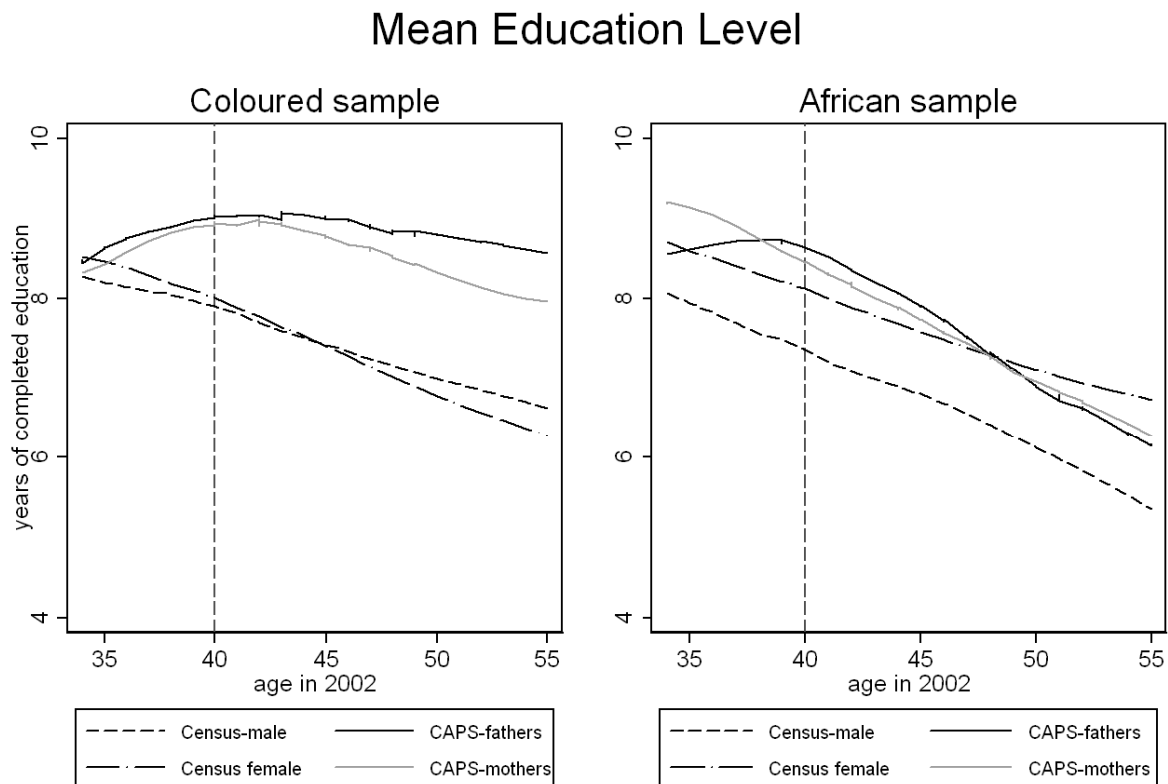
4. Early childbearing analysis

4.1 Mean characteristics

Young adults are classified as being born to a teen mother if their mother was under the age of twenty at their birth. Table 4 presents the characteristics of the data and compares the mean levels for children born to teen mothers versus older mothers. Separate means are presented for coloureds and Africans. 14 percent of young adults are born to a mother younger than age 20. The CAPS young adult sample included 14 to 22 year olds in 2002 and therefore, by design, young adults born to teen mothers have younger mothers in 2002. The difference in age between older mothers and teen mothers is close to a decade for both population groups.

To control for potential selection of poorer SES women into early childbearing, pre or childhood characteristics need to be controlled for during analysis. In our explicit control model, we control for parents education levels and a subjective measure of childhood poverty where each young adult is asked whether they would rate their childhood household as poor or very poor. For coloureds, there are no significant differences between parents education levels based on the mothers age at birth; at the mean parents achieve around 8.5 years of education. For Africans, the data shows that both mothers and fathers of children born to teen mothers have significantly more education.

Figure 1.



Data: Census 2001 Western Cape Urban sample, own calculations
CAPS 2002 data restricted to those YA's where both parents' education known

Figure 1 puts this into context. Figure 1 presents the relationship between mean education levels and age. The Western Cape urban Census 2001 data⁸ is used as a benchmark to assess the CAPS parental education data which, by design, selects only parents who had children aged 14-22 in 2002. The Census data shows that there have been strong increases in educational attainment over the past few decades. Observing the African Census female trend in the right hand panel of figure 1, we see that African females age 55 in 2002 had approximately 7 years of education, while 35 year old females in 2002 had close to 9 years of education. Assuming that most people would have completed their education by age 35, this marks a 29 percent increase in mean attained education level over these two decades. Since the CAPS teen mother sample is selective of younger mothers and fathers and the CAPS non-teen mother sample is selective of older mothers and fathers, we would expect the trend in educational attainment and age to have a steeper slope for the CAPS sample. This is evident for the CAPS African mother data, the increase over the two decades is close to 40%. A similar trend is seen for the African fathers, except for a downward turn for the youngest fathers. This turn is discussed below. The increase in educational attainment over the past two decades explains the significantly higher parental education levels for teen mothers in the African data.

Figure 1 suggests another point worth noting. Mother's who gave birth to young adults in our sample during their teens are under 41 years old (mean at 35), while mothers who gave birth to the young adults in our sample after their teens are 34 or older (mean around 44). Thus the trend in education for the CAPS sample for women below the age of 40 is likely to be strongly influenced by the education levels of younger (teen) mothers. If, as is often assumed in the literature, teenage mothers forfeit some education as a result of their child's birth, we would expect there to be a downward bias. It is clear in Figure 1 that no such downward bias exists for African mothers although the fathers appear to attain less education. In the coloured sample, the left hand panel, we see a distinct upward trend in educational attainment by age for CAPS mothers younger than 40 in 2002. CAPS mothers aged 35 have education levels equivalent to CAPS mothers 12 years their senior. This suggests a negative effect of teenage childbearing on both mother and fathers' educational attainment. On the other hand, since women of poorer SES are more likely to select into early childbearing, the downward shift could be an indication of the CAPS younger mother sample being selective of parents of lower socio economic status and hence education.

Very few coloureds classified their childhood household as poor; while close to 27 percent of Africans classify themselves as poor. No significant differences in likelihood of childhood poverty are found for children born to teen mothers for either the coloured or African sample. Using these three measures of childhood socio economic status, we see no disadvantage for the average child born to a teen. If, however, we look at household characteristics in 2002, while African young adults born to teen mothers appear equally well-off if not better when compared to children born to older mothers, coloured young adults of teens appear to be at a disadvantage. They lived in larger households, with more children under 14, fewer assets, are more likely to classify their household as poor and have lower per capita income. One explanation could be that if a women has a child in her teens she is likely to live in a household where she is not the main decision maker or person in control of household resources, for instance she could live in her parents' home. If she delayed her birth to a later age the child is more likely to be brought up in a household where their mother is one of the key decision makers. Thus while a measure of childhood household resources may not differ between children born to teen versus older mothers, in this case measured by self reported poverty status, the person controlling these resources might differ and hence affect the child's future outcomes.

⁸ Aged one year to coincide with the CAPS 2002 data

If we look at the living arrangements of young adults during their first fourteen years of life, there are distinct differences between population groups and between children born to teen versus older mothers. Looking at columns 1 and 4 in Table 1, at the mean, coloured young adults spent more time living with both their mother and father during childhood than African young adults. While coloured children spent 66% of their first 14 years living with their fathers, African young adults spent only 49% of their first fourteen years living with their fathers. Africans, on the other hand, spend more time (23%) living with their maternal grandparent(s) than coloureds (18%). Comparing children born to teens with children born to older mothers, we see in columns 2 and 4 that children born to teens spend significantly less time living with their mother and father and more time living with their maternal grandparent(s). At the mean, coloured young adults spend 82%, 45% and 36% of their childhood living with their mothers, father and maternal grandparent(s) respectively while African young adults spend 76%, 34% and 40% with their mothers, father and maternal grandparent(s) respectively. Interestingly, coloured children born to teen mothers spend a similar proportion of their childhood living with their mother and father as the average amount spent by all African children.

These data highlight the complexity of household living arrangements in South Africa and that children born to teen mothers spend significantly different proportions of their childhood living with their mothers, fathers and maternal grandparents than children born to older mothers.

4.2 Estimation: outcomes for children of teen mothers

We estimate equations of the following form for each young adult outcome separately:

$$y_{ij} = \alpha + \beta T_{ij} + X'_{ij}\gamma + e_{ij}$$

y_{ij} is the young adult outcome of individual i in household j . The young adult outcome is modeled as a function of the mother's age at the young adult's birth ($T_{ij} = 1$ if child i in household j was born to a teen mother, =0 otherwise). β is our coefficient of interest; the effect of being born to a teen mother on the outcome variable. In addition to the teen mother indicator, individual level controls (X) are included. For the initial ordinary least squares (OLS) regression and the siblings fixed model, X includes only the age and sex of the young adult and an indicator for whether the mother's age was missing for reasons besides the mother being deceased. In the OLS regression with explicit controls, mother's education, father's education, indicators for whether these variables are missing, a childhood poverty indicator, an indicator if the childhood poverty measure is missing and the number of children the young adult has besides the young adult in question are included.

The sibling/cousin fixed effects model allows us to decompose the unobserved component of the above equation into

$$e_{ij} = f_j + u_{ij}$$

where f_j is the sibling/cousin fixed effect. This effect will account for all time invariant family level unobservable characteristics common to siblings/cousins living in the same household. The fixed effects model estimates the following equations:

$$y_{ij} - \bar{y}_j = \beta(T_{ij} - \bar{T}_j) + (X'_{ij} - \bar{X}'_j)\gamma + (u_{ij} - \bar{u}_j)$$

where \bar{y}_j is the average value of y across all siblings/cousins in household j . Subtracting the means for siblings/cousins within the same household removes f_j , the common characteristics between siblings/cousins.

Table 5 presents mean levels (presented in square brackets) and the β coefficient, i.e. the effect of being born to a teen mother on the measured outcomes, of each outcome from our regression analyses. Columns 1 through 4 are for the coloured sample and 5 through 8 the African sample. Each row represents a different regression and each column a different type of analysis. Column 1 and 5 represent the weighted means for the sample, columns 2 and 6 present ordinary least squares (OLS) results controlling only for young adults age and sex and hence represent the correlation between early childbearing and young adult outcomes. Columns 3 and 7 attempt to control for potential selection of women from poorer SES into early childbearing by including controls for poverty during childhood, mother and father's education (including a dummy variable to account for missing data) and the number of biological children the mother has besides the young adult in question. Columns 4 and 8 present results from a sibling/cousin difference analysis including young adult age and sex controls.

Comparing the mean levels of each outcome between the coloured and African samples in columns 1 and 5 respectively, we see large differences. At the mean, coloured young adults have better mathematics test scores (0.37 standard deviations above the total CAPS mean for their age compared to the African average of 0.27 standard deviations below the mean), are more likely to complete high school (50% complete high school compare to the African mean of only 32%) but are more likely to drop out of school by age 16 (27% of coloured young adults drop out of school before age 16 without having completed high school compared to 11% of African young adults). Grade progression rates are around 0.7 of a grade per year for both population groups, signaling relatively high repetition rates. These levels and differences between population groups are in line with the South African literature. Marteleto et al (2008) find that African young adults repeat more grades than their coloured counterparts but are far less likely to drop out of school at a young age. Ardington (2008) finds low levels of high school completion for both population groups with African young adults being less likely to complete high school than coloured young adults. Finally, the differences in the mathematics test scores are in part due to the disadvantage that many respondents in the African sample faced from answering the mathematics test in a second language, but also represents difference in quality of education received, a legacy from the apartheid discriminatory schooling policies.

The home environment outcomes also differ between population groups at the mean. While around 20% of both African and coloured young adults report they lived with an alcoholic while growing up, 5.9% of coloured young adults frequently feared physical abuse during their childhood compared to 2.4% of African young adults.

The stark difference in mean levels of both the control variables and measured outcomes motivated the analysis of Africans and coloureds separately. In addition, we test⁹ the hypothesis that the coefficients in our regression analyses are jointly statistically equal for the African and coloured analysis. We reject this hypothesis.

⁹ See table 2 row 1 in Appendix for F-test of the equality of coefficients between the coloured and African analyses

Table 5.

*Analysis: outcomes for children born to teen mothers
Ordinary least squares, explicit control OLS and sibling/ cousin fixed effects*

Outcome	Coloured Sample				African Sample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Level	OLS	OLS with explicit controls	Siblings fixed effects	Level	OLS	OLS with explicit controls	Siblings fixed effects
Age standardised mathematics score	[0.372]	-0.202*** (0.003)	-0.14** (0.064)	0 (0.107)	[-0.267]	0.003 (0.795)	-0.018* (0.01)	0.017 (0.018)
Grade progression rate	[0.737]	-0.04*** (0.005)	-0.036*** (0.013)	-0.015 (0.021)	[0.756]	-0.095 (0.114)	-0.237*** (0.061)	-0.098 (0.08)
Indicator: completed high school by age 20	[0.5]	-0.122** (0.011)	-0.097** (0.043)	-0.025 (0.095)	[0.318]	0.019 (0.656)	-0.063 (0.043)	-0.052 (0.084)
Indicator: dropped out of school by age 16	[0.266]	0.103*** (0.003)	0.097*** (0.032)	0.068 (0.058)	[0.105]	-0.031* (0.093)	0 (0.017)	0.008 (0.035)
Indicator: lived with an alcoholic when growing up	[0.214]	0.062* (0.063)	0.056* (0.033)	0.113** (0.047)	[0.192]	-0.041 (0.133)	-0.026 (0.029)	-0.064 (0.058)
Indicator: fear of frequent physical abuse when growing up	[0.059]	0.034* (0.058)	0.033* (0.018)	0.092*** (0.034)	[0.024]	-0.036 (0.182)	-0.017 (0.028)	-0.086** (0.036)

Notes to table 5: Variable means in square brackets. Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a household in wave 1 (2002). Variables included in all regressions are: mother's age being below 20 at child's birth indicator; missing mother's age indicator; young adult age and sex. Additional variables included in the OLS with explicit controls are: mothers education; missing mother's education; father's education; missing father's education indicator; poverty indicator; missing poverty indicator; number of children mother has in addition to the young adult. Significance of coefficients represented by * <0.1, **<0.05 and ***<0.01

Coloured young adults born to teens are at risk of poorer outcomes. The correlation between being born to a teen mother and worse outcomes is strong and significant for all outcomes. Over a ten year period, children of teen mothers drop behind by 0.4 of a grade, are 0.2 standard deviations below the mean mathematics score for their age, are 12% less likely to complete high school 10% more likely to drop out of school by age 16, are 6 % more likely to have lived in a household with an alcoholic during childhood and 3.4 % more likely to have feared frequent physical harm. Considering the level of these outcomes presented in column 1, these differences represent outcomes for children born to teens that are worse by an order of between 20 and 60 percent.

Column 3 shows that some of this negative affect is due to selection; the size and/or significance of the coefficients reduce once SES controls are included. This indicates that coloured women who have children during their teens are more likely to already be predisposed to poorer socio economic status prior to the birth of their child. Column 4 presents results estimating the differences between children (nieces/nephews) of the same mother. It shows that the direction of the academic outcome coefficients are the same as found in the OLS analysis, thus signaling a negative effect of early childbearing. However, these effects are reduced and the increased standard errors suggest that they are imprecisely measured. Children born to teen mothers are not at risk of worse educational outcomes when compared to their siblings (cousins).

On the other hand, when comparing siblings, children born to teen mothers are found to be at higher risk of exposure to worse home environments. In fact, the home environment outcome coefficients increase in size and significance substantially when sibling/cousins are compared. Children born to teen mothers are 11% more likely to have lived with an alcoholic and 9% more likely to have feared physical harm during their childhood than their siblings/cousins born to their mother/aunt after her teens. These effects are large; they represent a 50% and 150% increase from the mean level of alcoholism and abuse respectively in coloured young adults' sample. Thus while being born to a teen mother does not appear to place the child at a disadvantage at school in comparison to their siblings (cousins), it does appear to adversely affect their childhood home environment.

Children born to African teen mothers do not appear to be at risk of worse outcomes. In column 6 we see coefficients are small with large standard errors signaling the absence of a strong negative correlation between the African young adult outcomes and the teen mother indicator that is expected from the literature. Indeed, children of teen mothers are less likely to drop out of school by age 16, a positive result. Column 7 controls for potential SES selection. The positive dropout result is eliminated and two significant negative results are found. Controlling for parents' level of education, childhood poverty status and mother's number of biological children, children born to teen mothers are more than 0.2 of a standard deviation below the mean mathematics score for their age and progress through their grades at a slower rate. Thus, we see a reversal of the sign of the correlations on these coefficients in column 6 and 7. This is most likely explained by the increase in education over the past two decades which, as seen in table 4, resulted in the parents of young adults born to teens in our data having significantly higher educational attainment. Since parental education is significantly associated with better child outcomes, it is likely that in column 6, children born to teen mothers are protected by their younger parents' higher education. In column 7 once parental education is controlled for, children born to teen mothers are found to be at risk of worse mathematics scores and slower grade progression rates. These results are not robust to analysis between siblings/cousins as seen in column 8. Children born to teen mothers are not at a disadvantage in any of the measured outcomes when compared to their siblings/cousins born to their mother/aunt when she was older. In fact, children born to teen mothers are less likely to report physical abuse during childhood than their younger siblings/cousins.

4.3 Sensitivity checks

4.3.1 Systematic difference hypothesis

Shifting to the siblings' difference estimates in table 5, results in reduced coefficient size and insignificant coefficients for all but the home environment outcomes. This could be a result of the sibling estimates better controlling for unobservable household and mother characteristics and hence removing the selection effect. Alternatively, it could be the result of a situation in which, for a teenage mother, the outcomes for all her children are negatively affected and not just the outcomes of the child she bore during her teens. Turley (2003) calls this the "systematic difference" versus the "maternal maturity" hypothesis. When we look between siblings we are testing the "maternal maturity hypothesis". This hypothesis implicitly assumes that the factors which result in the child having worse outcomes are restricted to the child she gave birth to in her teens and that children born later are exempt from these negative effects.

Table 6 presents results for a sample restricted to children not born to teen mothers. The variable of interest in columns 1 and 4 is whether the mother ever reported giving birth in her teens¹⁰, in other words if she gave birth to the child's sibling during her teens. Columns 2, 3, 5 and 6 will be discussed in the next section. As in table 5, each row represents a separate regression and results are presented for coloureds and Africans separately. Coloured children born to mothers' who gave birth to their older sibling during their teens are found to do significantly worse on the mathematics test. In addition, while the teen mother coefficient is imprecisely measured for the other educational outcomes, the direction of these coefficients suggests a negative effect for all the educational outcomes of your mother ever having given birth to a child in her teens. This suggests that a possible reason for the absence of an effect when looking between siblings could be that all children born to a mother who ever had a child during her teens have a risk of worse educational outcomes. The opposite is true for the home environment outcomes. Coloured young adults whose older siblings were born to their mother during her teens are significantly less likely to report fear of physical abuse during their childhood. This could be a contributing factor in the increase of the teen mother coefficient between the OLS regression and the siblings fixed effect regression analyzing the determinants of physical abuse. In table 5, the coefficient on the teen mother variable increased from 0.033 in the OLS with explicit control analysis, to 0.092 in the fixed effects analysis. Part of this increase is likely a result of younger sibling being less likely to report physical abuse during childhood. In summary, the educational outcomes of all children of mothers who ever had a child in her teens appear negatively affected, while the negative teen mother effect on home environment outcomes is isolated to the child she gave birth to in her teens. No similar effects are found in the African sample.

¹⁰ Note that this is a noisy measure as mothers who did not have ya's as teens could however have had a child during their teens. This would however bias the sample towards not finding results assuming the negative correlations found hold

Table 6.
Sensitivity checks: the effect of having a teen mother and the effect of birth order on young adult outcomes

	Coloureds			Africans		
	(1)	(2)	(3)	(4)	(5)	(6)
	Coefficient for indicator of whether mother ever gave birth in her teens	Coefficient on indicator of whether young adult is the oldest sibling		Coefficient for indicator of whether mother ever gave birth in her teens	Coefficient on indicator of whether young adult is the oldest sibling	
Outcome	OLS with explicit controls	OLS with explicit controls	Siblings fixed effects	OLS with explicit controls	OLS with explicit controls	Siblings fixed effects
Grade progression rate	-0.019 (0.02)	-0.007 (0.009)	-0.029 (0.032)	-0.019 (0.015)	0.002 (0.008)	0.038* (0.021)
Age standardised mathematics score	-0.196** (0.093)	0.009 (0.059)	-0.067 (0.161)	0.014 (0.096)	-0.047 (0.05)	-0.059 (0.105)
Indicator: completed high school by age 20	-0.059 (0.079)	-0.029 (0.033)	-0.105 (0.125)	0.008 (0.057)	0.004 (0.031)	0.045 (0.092)
Indicator: dropped out of school by age 16	0.033 (0.051)	0.027 (0.025)	0.026 (0.087)	0.008 (0.046)	-0.006 (0.017)	-0.106** (0.045)
Indicator: lived with an alcoholic when growing up	-0.01 (0.047)	-0.021 (0.024)	0.043 (0.071)	0.037 (0.038)	-0.026 (0.026)	-0.092* (0.048)
Indicator: fear of frequent physical abuse when growing up	-0.042** (0.021)	-0.006 (0.011)	-0.048 (0.048)	-0.008 (0.318)	0.021** (0.01)	0.026 (0.021)
Number of observations	1623	1623	1623	1696	1696	1696
Number of households	1176	1176	1176	1175	1175	1175

Notes to table 6: Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a household in wave 1 (2002). Variables includes in all regressions are: young adult age and sex; mothers education; missing mother's education; father's education; missing father's education indicator; poverty indicator; missing poverty indicator; number of children mother has in addition to the young adult. Significance of coefficients represented by * <0.1, **<0.05 and ***<0.01

4.3.2 Birth order effects

Due to the absence of birth order measures in the CAPS data and the high correlation between the teen mother variable and being the oldest young adult in the household (a measure we do have), the analyses presented in table 5 do not control for birth order. Thus another concern is that the true effect of being born to a teen mother is being masked or exaggerated in our analysis due to a birth order effect. Table 6, columns 2, 3, 5 and 6, present the coefficient on whether the YA is the oldest of their mothers' children¹¹. The sample is again restricted to children not born to teen mothers. As before each row represents a different regression. All coefficients are small and insignificant with the exception of older African children being found to progress through grades at a faster rate than their younger siblings, be less likely to report having lived with an alcoholic during childhood and marginally more likely to have feared physical abuse. Since we find no negative effect of being born to a teen mother on the grade progression rate and alcoholic outcomes for Africans in Table 5, the fact that older children are found to do better might suggest that a negative teen mother effect is being masked by older siblings doing better. In summary, there does not appear to be a strong birth order effect for the coloured sample; when older children are compared to their younger siblings no significant differences are found on the measured outcomes. Thus the results in table 5 are unlikely to be strongly biased by the absence of a birth order control. For Africans, older siblings progress through school faster and report better childhood home environments. Thus the results in table 5 for Africans might be positively biased by the exclusion of a birth order control in the analysis.

In sum, the results presented in sections 4.2 above suggest that children born to coloured teen mothers appear to be at risk of worse educational and home environment outcomes, while children born to African teen mothers do not appear to fare differently, with the possible exception of a negative effect on their mathematics scores. While these are interesting results, they tell us nothing about the mechanisms through which being born to a coloured teen mother result in negative educational and home environmental outcomes and why African YAs born to teen mothers appear to be exempt from these mechanisms. We look at the family living arrangement of the young adult during their childhood in an attempt to elicit whether living arrangements during childhood play a part in mitigating or augmenting the effect of being born to a teen mother.

4.4 Channels: do living arrangements during childhood matter?

The previous sections found that coloured children born to teen mothers are at risk of worse education and home environment outcomes in young adulthood, but that a similar risk is not found for African children born to teen mothers. To better understand what risks coloured children are exposed to through being born to teen mothers and why African children of teen mothers do not appear to be exposed to any additional risk we examine whether childhood living arrangements impact the measured outcomes. This will enable a discussion of whether childhood living arrangements are a channel through which the outcomes of children born to teen mothers are affected.

In table 4 we saw that children born to teen mothers spend significantly less time during their childhood living with their mothers and fathers and significantly more time living with their maternal grandparent(s) than children born to older mothers. In Table 7.1 and 7.2 we assess whether these differences in living

¹¹ This is crudely defined as the YA is the oldest of the young adult siblings within the household with an adjustment to zero if the mother reports that she has children over the age of 23

arrangements are a channel through which being born to a teen mother effects young adult outcomes. Unlike in the previous tables, in Table 7.1 and 7.2 each column represents a different regression. Table 7.1 presents the results for the coloured sample and Table 7.2 present the results for the African sample. The first column for each outcome replicates the coefficient on the teen mother indicator, β from Table 5. This is to be used as a benchmark to assess the effect of including variables specifying the proportion of childhood the young adult spent with their mother, father and maternal grandparent(s). The results including these controls are shown in the second column for each outcome.

For coloured young adults, living a greater proportion of childhood with their father or maternal grandparent(s) is protective of certain negative outcome. Coloured young adults who lived a greater proportion of their childhood with their fathers progress through school faster, have better mathematics test scores, are more likely to complete high school and less likely to report having lived with an alcoholic during childhood. Living a greater proportion of childhood with maternal grandparents is protective against dropping out of school, not completing high school and physical abuse. Lastly, the time a young adult spent with their mother during childhood has little effect on their young adult outcome, except that a greater amount reduces the chances of living with an alcoholic during childhood.

Comparing the size and significance of the teen mother coefficient, we see that the inclusion of the living arrangement variables reduces the size and significance of all but the physical abuse outcomes, albeit marginally in most cases. Since the presence of a father has the strongest effect and children born to teen mothers spend on average less time with their fathers during childhood, this indicates that living less time with their fathers is a negative channel through which the effect of being born to a teen mother impacts young adult outcomes. The physical abuse outcome coefficient increases in size and significance with the inclusion of the living arrangement variables. The proportion of childhood spent with maternal grandparent(s) coefficient is significance and protective in this instance. Since children born to teen mothers spend a larger proportion of their childhood living with maternal grandparent(s) this signifies that living more time with maternal grandparent(s) mitigates the negative effect of being born to a teen mother on the physical abuse outcome.

Childhood living arrangements are therefore one of the channels through which the effect of being born to a teen mother impact young adult outcomes. For all but the physical abuse outcome, the total effect of spending less time with you mother and father and more time with your grandparent(s) during childhood is negative. In other words, childhood living arrangements are a channel through which being born to a teen mother negatively affects young adult outcomes.

No similar father and maternal grandparent(s) protection is found for the African sample. In fact, young adults who spent a larger proportion of childhood living with their fathers or grandparents are significantly more likely to report having lived with an alcoholic during childhood. Hence, the fact that African children born to teen mothers spend less of their childhood with their fathers is protective. This is however offset by the increase in time spent with grandparent(s). On the other hand, Africans who spent a larger proportion of childhood with their mothers are protected from worse outcomes for all outcomes measured. This effect is significant for the mathematics test score and physical abuse outcomes.

We investigated whether children born to teen mothers were differentially affected by childhood living arrangements than children born to older mothers through the inclusion of interaction terms between the living arrangement variables and the teen mother indicator. These were found to be insignificant in all cases except for one outcome, the presence of an alcoholic in the coloured YA's household during childhood.

Including the interaction between being born to a teen mother and the proportion of childhood lived with your father, increased the teen mother coefficient to 0.1 (from 0.034 when only the living arrangement main effects are included). This indicates that for children who spend no time with their fathers, children born to teen mothers' are 10% more likely to report having lived with an alcoholic during childhood than children born to older mothers. This negative effect is more than offset if the child spends his/her entire childhood living with their father.

5. Conclusion

Coloured young adults born to teen mothers are found to be at risk of poorer educational and home environment outcomes. In accordance with the international literature some of these effects are a result of women of poorer socio economic status selecting into early childbearing. However, even when we control for young adults having the same mother and hence similar SES, the negative home environment outcomes remain. Children born to teen mothers are more likely to live in households with a resident alcoholic and to fear physical abuse during childhood than their younger siblings/cousins.

The effect of being born to a teen mother is less conclusive for Africans. There is very little correlation between being born to a teen mother and young adult educational and home environment outcomes. In fact, we find some weak correlations between better outcomes and being born to a teen, although these positive findings are likely a result of the fact that in our sample, the children born of teen mothers have younger and hence more educated parents which is protective of worse outcomes. Controlling for parental education and childhood poverty results in two negative educational outcomes; African children born to teen mothers are below the mean mathematics score for their age and progress through school at a slower rate. However, when we compare siblings/cousins, children born to teens are not found to be disadvantaged and are found to be less likely to report physical abuse during childhood.

Differences in childhood living arrangements are found to be a channel through which a child born to teen mothers' young adult outcomes are affected. Increasing the time coloureds spend living with their fathers and maternal grandparent(s) during childhood protects them from worse outcomes. For African young adults spending more time with their mother is protective. Since children born to teens spend less of their childhood living with their mothers and fathers this means that less time spent with parents is a negative channel through which the outcomes of children born to teen mothers are affected. Children born to teen mothers spend more time living with their maternal grandparent(s), thus presenting a channel through which children born to teen mothers are protected. In total, the effect of childhood living arrangements on children born to teen mothers is negative; being born to a teen mother exposes the child to childhood living arrangements that are not, on the aggregate, beneficial to their outcomes.

Our results for the coloured sample are in line with the international literature. High correlations reduced once selection is controlled for. The African sample however, is quite different. No correlation between worse outcomes and being born to a teen mother is found. Childhood living arrangements are not found to be especially important in preventing worse outcomes, with the exception of the presence of the mother protecting the child. Controlling for parental education and childhood poverty levels, results in slower progression rates and lower mathematics test scores for children born to teen mothers. Higher parental education is strongly associated with better outcomes for the young adult. Since African parents of children born to teen mothers have significantly more education than older parents due to the increase in attained education levels over the past two decades, this signals that higher parental education is a channel through which the young adults born to teen mothers in our sample are protected from worse mathematics scores and

slower progression rates. Since this is a function of our sample it would not apply when comparing children born to teen versus older mothers from the same generation, i.e. where the mothers are from similar birth cohorts.

Table 7.1. -Coloured Young adults
Channels: living arrangements during childhood

	Grade progression rate		Age standardised mathematics score		Indicator: completed high school by age 20		Indicator: dropped out of school by age 16		Indicator: lived with an alcoholic when growing up		Indicator: fear of frequent physical abuse when growing up	
Indicator: Teen mother	-0.036***	-0.034***	-0.140**	-0.104	-0.097**	-0.076*	0.097***	0.090***	0.056*	0.034	0.033*	0.040**
	(0.01)	(0.01)	(0.06)	(0.07)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
Prop of childhood lived with mother		-0.005		-0.083		-0.066		-0.064		-0.081*		0.005
		(0.02)		(0.11)		(0.07)		(0.05)		(0.05)		(0.02)
Prop of childhood lived with father		0.021*		0.275***		0.214***		-0.052		-0.070**		0.007
		(0.01)		(0.08)		(0.05)		(0.03)		(0.03)		(0.02)
Prop of childhood lived with maternal grandparent(s)		0.014		0.041		0.106**		-0.058*		-0.001		-0.031*
		(0.01)		(0.08)		(0.05)		(0.03)		(0.03)		(0.02)
Observations	1651	1651	1855	1854	1153	1153	1836	1835	1865	1864	1874	1873

Notes to table 7.1: Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a household in wave 1 (2002). Variables included in all regressions are: mother's age being below 20 at child's birth indicator; missing mother's age indicator; young adult age and sex; mother's education; missing mother's education; father's education; missing father's education indicator; poverty indicator; missing poverty indicator; number of children mother has in addition to the young adult. Significance of coefficients represented by * <0.1, **<0.05 and ***<0.01

Table 7.2. -African young adults
Channels: living arrangements during childhood

	Grade progression rate		Age standardised mathematics score		Indicator: completed high school by age 20		Indicator: dropped out of school by age 16		Indicator: lived with an alcoholic when growing up		Indicator: fear of frequent physical abuse when growing up	
Indicator: Teen mother	-0.018*	-0.012	-0.237***	-0.217***	-0.063	-0.053	0	0	-0.017	-0.025	0.018	0.017
	(0.01)	(0.01)	(0.06)	(0.06)	(0.04)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)
Prop of childhood lived with mother		0.019		0.193**		0.052		0.009		-0.015		-0.025*
		(0.01)		(0.08)		(0.06)		(0.03)		(0.03)		(0.01)
Prop of childhood lived with father		0.002		-0.045		0.039		-0.007		0.045*		-0.002
		(0.01)		(0.06)		(0.04)		(0.02)		(0.02)		(0.01)
Prop of childhood lived with maternal grandparent(s)		-0.016		-0.069		-0.012		-0.005		0.073**		-0.005
		(0.01)		(0.07)		(0.04)		(0.02)		(0.04)		(0.01)
Observations	1720	1720	1933	1933	1245	1245	1899	1899	1954	1954	1961	1961

Notes to table 7.2: Robust standard errors presented in parentheses, estimated allowing for correlation between observations sharing a household in wave 1 (2002). Variables included in all regressions are: mother's age being below 20 at child's birth indicator; missing mother's age indicator; young adult age and sex; mother's education; missing mother's education; father's education; missing father's education indicator; poverty indicator; missing poverty indicator; number of children mother has in addition to the young adult. Significance of coefficients represented by * <0.1, **<0.05 and ***<0.01

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Appendix A:

Table 1.
Literature summary

<i>Authors</i>	<i>Findings</i>			<i>child or youth?</i>	<i>method</i>	<i>data</i>	<i>control for unmeasured background characteristics</i>	<i>How deal with birth order issue</i>
	negative	none	positive					
Barber (2001)		child's fertility timing						
Cooksey (1997)	reading recognition and comprehension	mathematical ability						
Francesconi (2008)	More likely to be economically inactive, have a child in their teens them self and be in the bottom earnings decline. Less likely to be in the top income decile	education (although negative if child of teen interacted with non-intact family in first 16 years of child's life), hourly wage, smoking, psychological distress (although significant negative effect when teen age mother interacted with childhood poverty proxy)		youth	Sibling (and half-sibling) fixed effects. Also do standard multivariate regressions, non-parametric estimates and Manski bounds	British Household Panel Survey	yes	Includes number of brothers and sisters, dummy for first-born. Seems problematic given that the correlation between firstborn and teen mother is going to be close to one within sibling pairs
Geronimus & Korenman (1993)		infant health	infant health	child	cousin fixed effects			
Geronimus, Korenman & Hillemeier (1994)		academic test scores, behavioural problems for young children, home environments		child	cousin fixed effects		yes	Two approaches: 1) include birth order dummies 2) restrict sample to first born children only
Grogger (1997)	male incarceration rates			youth		NLSY79-91	yes	include birth order controls

Hardy et al (1997)	educational attainment, early fertility, economic outcomes							
Haveman et al (1997)	high school graduation, teen fertility	economic inactivity at age 24(once control), teen out of wedlock fertility(once control)		youths	multivariate analysis including preadolescent and policy environment controls	PSID	no	Include firstborn control
Hofferth and Reid (2002)	children's behavioural problems, comprehension test	other achievement tests						
Levine et al (2001)	behaviour outcomes (sex before 17, fighting and truancy)	academic outcomes (including grade repetition)		child and youth	Explicit control (multivariate) analysis. Also do cousin FE and miscarriage but don't show results as sample too small	NLSY	say do but don't show results	
Levine et al (2007)	FF: More likely to repeat a grade, use marijuana and a slightly significant increase in truancy	Nothing significant when using miscarriage analysis, with some positive effects found (not significant). Fixed effects model: academic (maths, reading comprehension and PPVT-R) test score, sexual activity before age 16, fighting		child and youth	first pregnancy miscarriage as a instrument for teen motherhood, fixed effect cousin and sibling comparisons (when the variation in teen mother does not vary between siblings the variation occurs between cousins), multivariate regression with background controls	NLSY79 and CNLSY79	yes	Include birth order and number of children in family as controls

Moore & Snyder (1991)		child's PPVT scores for white sample	child's PPVT scores for Hispanic and African-American samples	child (age 3-7)	Multivariate OLS analysis controlling for mothers' cognitive attainment (AFQT score), maternal background characteristics and home environment during child's early life	NLSY1986	no	use only firstborns
Moore et al (1997)	academic tests, behavioural problems, home environment				Multivariate analysis controlling for household and family characteristics, but not for mother's academic ability.	NLSY90		
Turley (2003)	reading (very small coefficient)	academic test scores trajectory, behavioural problems for young children			cousin fixed effects	NLSY1986-1998	yes	Use a sample of non-firstborns when assessing whether systematic difference hypothesis holds. Use only firstborns in cousin fixed effects analysis
Zimmerman et al (2001)	sexual behaviour	psychological well-being, school outcomes and many behavioural outcomes			MANOVA analyses, only control for mother's education		no	

Table 2.
Tests of coefficient equality between the coloured and African regressions

	Grade progression rate	Age standardised maths score	Indicator: completed high school by age 20	Indicator: dropped out of school by age 16	Indicator: lived with an alcoholic when growing up	Indicator: fear of frequent physical abuse when growing up
All coefficients jointly	6.26*** (0)	10.90*** (0)	3.54*** (0)	17.26*** (0)	2.29** (0.01)	3.71*** (0)
<i>Individual coefficient:</i>						
Indicator: Teen mother	1.18 (0.28)	1.20 (0.27)	0.30 (0.59)	6.96** (0.01)	2.83* (0.09)	0.39 (0.53)

Notes to table 2 (appendix): F-tests for coefficient equality with associated p-value presented in brackets. Significance of coefficients represented by * <0.1, **<0.05 and ***<0.01