Reducing Adolescent Risky Behaviors in a High-Risk Context: The Effects of Unconditional Cash Transfers in South Africa

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Introduction

Adolescence, the period of life between 13 and 18 years, is typically marked by a growing independence from parents, greater reliance on the judgments of peers, and increased exposure and interest in novel activities. At the same time, adolescent brains are restructuring, with their actions guided much more by the amygdala (the part of brain that is responsible for instinctual reactions) and less by the prefrontal cortex (the part of the brain that controls reasoning; AACAP 2011). Consequently, adolescents are more susceptible to risky behaviors such as using alcohol, tobacco, and drugs and early sexual debut. These are global concerns, and yet global sources of data and indicators for tracking and comparing risks of and exposure to these behaviors and their consequences are sorely lacking (Heymann and McNeil 2013).

Early sexual debut is of particular concern in environments where HIV prevalence is high. More than 10% of the population in South Africa is living with HIV, with young people (age 15–29 years) at greatest risk. A nationally repre-

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sentative, population-based survey in 2003 (Reproductive Health and HIV Research Unit South African Youth Survey) identified an especially high HIV prevalence rate for South African females between age 18 and 24 years of 20.8% (Pettifor et al. 2011). This rate compared with less than 1% for females of the same age in the United States (surveyed in the National Longitudinal Study of Adolescent Health in 2001 and 2002), despite the fact that US females reported riskier sexual behaviors, including an earlier age of sexual debut, more partners, and a lower probability of condom use, although South African females had older partners. The 2008 South African National HIV Survey reported that 21.1% of females age 20–24 were HIV positive, with the highest prevalence rates among females age 25–29 years at 32.7%.[1] An editorial in the *Journal of Adolescent Health* (Jaspan 2011, 227) asserted that the high prevalence of HIV among young people in South Africa reflects "the enormous risk associated with adolescence in South Africa," describing this situation as a "state of emergency" for the country.

In addition, South Africa has one of the highest volumes of per capita alcohol consumption in the world (Parry 2005), and alcohol use is consistently associated with sexual risk taking, sexual coercion, and heightened risks for HIV infection in southern Africa (Kalichman and Kaufman 2007). Morojele et al. (2004) found that South African women are more likely to drink with their sex partners. Studies also specifically show that alcohol and other drug use among adolescents and youth in South Africa is associated with sexual risk behavior and that adolescent alcohol and other drug users are more likely than nonusers to have multiple sexual partners (Brook, Morojele, and Brook 2006; Morojele, Brook, and Kachieng 2006; Plüddemann et al. 2008; Ramsoomar and Morojele 2012). Furthermore, the role of poverty in influencing youth risky behaviors, particularly involvement in transactional and intergenerational sex and substance use, is increasingly recognized in this research.

Growing evidence suggesting that risky behaviors, particularly sexual activity, vary with household consumption expenditures and income shocks portends promise for the role of cash transfer programs in helping to mitigate risky behavior, as well as poverty and hunger (Robinson and Yeh 2009; Wilson 2012). Perceptions of a lack of economic opportunity or powerlessness associated with poverty, especially among girls or young women, can lead young people to heavily discount the costs of risky behavior, as they undervalue the future

[1] The National HIV Survey in South Africa was a household survey administered in 2008 to a representative sample (cross-section) of households. A total of 15,851 individuals completed an HIV test. Additional information and statistics can be downloaded here: http://www.avert.org/south-africa-hiv-aids-statistics.htm.

or overvalue short-term gratification (Medlin and de Walque 2008). Thus, direct cash transfers to the poor by governments have potential not only to reduce poverty and inequality (by redistributing resources to poor households) but also to alter individual and household incentives and decision making in ways that affect short- and long-term outcomes (Fiszbein and Schady 2009). Indeed, Baird et al. (2012) found in Malawi that cash transfer programs reduced HIV and HSV-2 infections in adolescent schoolgirls in low-income areas and that it was not necessary to directly address their sexual behavior to achieve these results.

In this article, we present findings from a study of the effects of the South African Child Support Grant (CSG), an unconditional cash transfer program, on adolescents' engagement in risky behaviors. When the CSG was first introduced in 1998, the grant was limited to households with children younger than 7 years old (Agüero, Carter, and Woolard 2007). Over the subsequent 14 years, the age limit for CSG eligibility increased multiple times, until it was ultimately extended in 2012 to cover children up until their eighteenth birthday (South African Government 2012). These policy changes led to variation in the age of first receipt of the grant (timing) and the duration or dosage of the cash transfer, which we use to investigate the potential effects of an unconditional cash transfer program on children in adolescence, although we do not assert that these relationships are causal. Furthermore, the substantial expansion of the grant's coverage to over 11 million beneficiaries makes it one of the most important policy initiatives to respond to the "state of emergency" faced by South African youth today (SASSA 2014).

We begin with a brief review of the literature and the motivation (or theory of change) underlying the role of cash transfers in reducing adolescent risky behaviors. We then provide additional details about the South African CSG along with a description of the data used in the evaluation. The treatment and comparison groups and methodologies applied in evaluating the program effects are described next, followed by the study findings and a discussion of their policy implications. The study results suggest that cash transfer programs may play an important role in reducing risky behaviors among youth who are vulnerable because of their poverty.

Background and Theory of Change

In a seminal study of adolescent engagement in risky behavior, Jessor (1992) conceptually defined four primary domains (or sources) of risk: social environment risk, perceived environment risk, personality risk, and biology/genetics. Particularly salient for the role of cash transfer programs is the theoretical proposition that the effects of any one of these risk domains may be mediated through other risk domains. For example, beyond their direct effects, social environment risk factors such as poverty and discrimination may influence individuals' perceived life chances (in the personality risk domain). As Jessor elaborates, youth growing up in adverse social environments are put in "double jeopardy," as they face risk factors that are more intense and prevalent—and that exacerbate risk in other domains—while protective factors are simultaneously less likely to be within reach. In addition, recent neuroscience findings suggest that adolescents experience more difficulty in assessing risk and making appropriate choices than either their older or younger counterparts (Howard-Jones, Washbrook, and Meadows 2012). Unfortunately, in environments such as those faced by South African adolescents, unwise choices and engagement in risky behaviors are also more likely to have irrevocable negative effects.

The implications of psychosocial models for youth engagement in risky behaviors are largely consistent with those of economic models, which assume that individuals make choices with the goal of maximizing their own well-being (utility), including riskier choices with payoffs (e.g., personal enjoyment or financial gain) that have to be traded off with costs (e.g., health risks). If youth are more likely to undervalue the future in the face of difficult environments and limited opportunity and thereby heavily discount the costs of risky behavior, what appears to be irrational risk-taking behavior may actually reflect a realistic valuation of the short-term and long-term (probabilistic) benefits and costs (O'Donoghue and Rabin 2001). Furthermore, this problem may be magnified if the costs of engaging in risky behaviors are not fully understood or perceived in the short-term (e.g., because of lags between exposure or infection and full-blown illness), whereas gains are more immediate. Accordingly, cash transfer programs can offer a substitute (e.g., immediate cash benefits), or an incentive if conditional (i.e., a reward for declining risks), that alters adolescent valuations of the benefits and costs (or trade-offs) and their choices to engage (or not) in risky behaviors (Medlin and de Walque 2008; de Walque et al. 2012).

In fact, a review of 16 studies in which cash payments were used to reduce HIV risk associated with sexual activity—by either addressing structural risk factors such as poverty (the large majority of these studies) or by incentivizing behavioral change—found positive changes on sexual behavior in nearly all studies (Pettifor et al. 2012). Fifteen of these 16 studies focused on adolescents and were randomized controlled trials (RCTs), and six examined the effects of unconditional cash transfers. Although only one large RCT had preliminary results available on HIV outcomes (at an 18-month follow up), the findings showed a lower HIV prevalence among intervention participants than controls (Baird et al. 2012). Baird et al.'s (2011) findings from one of the first

RCTs of conditional and unconditional cash transfers in Malawi also showed that the largest effects of cash transfers on sexual behavior were among adolescent girls who dropped out of school but continued to receive unconditional cash transfers; their likelihood of ever being pregnant was reduced by 27%. And although Kohler and Thornton (2012) found no effect on HIV status of incentives offered to reduce sexual behavior, they did find that women were 6.7 percentage points less likely to engage in risky sex.

The literature also distinguishes between risks for initiating or becoming involved in risky behaviors (for those not yet involved) and risks of health and life-compromising outcomes, such as poor school performance, early pregnancy, arrest or incarceration, and so on, for those already involved. Cash transfer programs may have the potential to address both of these types of risk if they reach youth and adolescents early enough. Research showing that increases in household income protect females from early sexual debut (while negative economic shocks increase their probability of early debut) provides support for this potential causal pathway (Dinkelman, Lam, and Leibbrandt 2008). In this study, we examine the effects of the South African CSG (cash transfer) on adolescent behavior for youth who commenced receiving it at an earlier age (and for whom it may help to prevent initiation), as well as for those who did not begin receiving the CSG until adolescence, although we do not make claims of causal attribution based on our analysis.

Program and Evaluation Data

The CSG is a means-tested, unconditional cash transfer program (based on household income) that is paid to the child/adolescent's parent or caregiver (R 320, or about US$21, per month as of October 2014), with corresponding thresholds set at R 38,400 per year (about $2,500) for single caregivers and R 76,800 per year (about $5,000) for married couples (Hall 2013). Over time, in addition to extending the age of eligibility for the grant, the South African Department of Social Development (DSD) changed application requirements to reduce transaction burdens and barriers to grant receipt, which led to increased take-up rates in poorer areas (Samson, Heinrich, and Regalia 2011). Thus, with expanded take-up among households (particularly those with adolescents) and given the possible sizable addition to household income of the CSG, we suggest that there is realistic potential for the CSG to have an effect on adolescent behavior and outcomes via the mechanisms discussed in the preceding section. We examine the potential effects of South Africa's (unconditional) cash transfer program on sexual activity and number of sex partners, alcohol use, and drug use among adolescents.

Data Collection

The data used in this research draw primarily on a survey designed to measure the effects of the CSG in five South African provinces: Western Cape, Eastern Cape, KwaZulu-Natal, Gauteng, and Limpopo. These data are complemented by information extracted from the South African Social Security Agency (SASSA) administrative databases. When a caregiver applies for the CSG at a SASSA office, the information provided is entered into a management information system that is used to determine eligibility for the grant and to track grant recipients. Accessing these SASSA data, which include the household location, income for the means test, and age and sex of the child beneficiary, allowed us to construct a sample frame for this study (i.e., children receiving the grant).

The initial plan for evaluating the effects of the CSG on adolescents was to use a recent change in the age of eligibility for the CSG, from 15 to 16 years of age in 2011 (see fig. 1), that would allow for a comparison of adolescents of a similar age—those just below (potential beneficiaries) and those just above (not eligible) the new age eligibility cutoff for CSG receipt, similar to Eyal and Woolard's (2011) analysis of younger children. In constructing the sample for this analysis, primary sampling units, or PSUs (i.e., the geographical areas or physical location where beneficiaries received their payments), were first selected with a probability proportionate to the size of the CSG beneficiary pop-

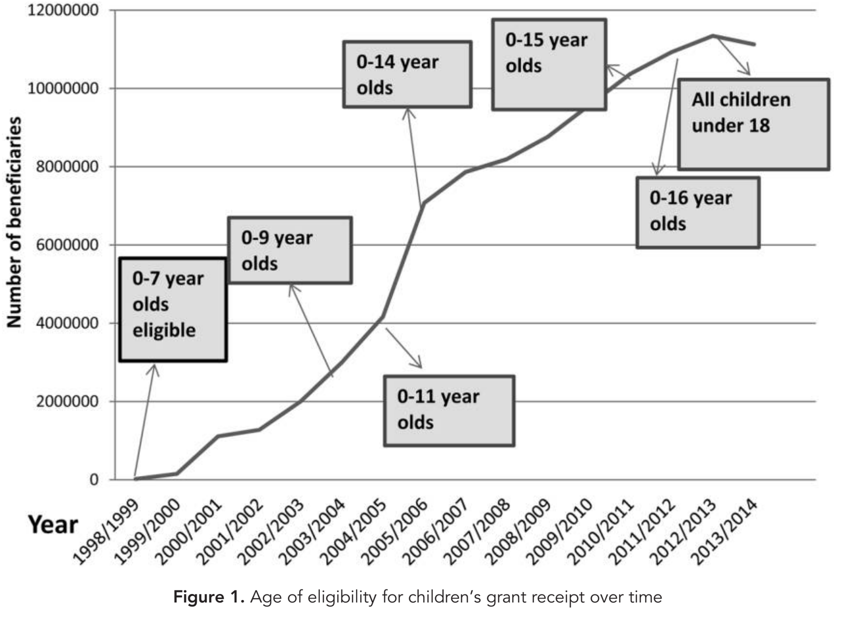

Figure 1. Age of eligibility for children's grant receipt over time

ulation.[2] Within these selected PSUs, households with a "focal child" age 15–16 years old who was a CSG beneficiary were randomly selected using SASSA administrative data that verified the households' eligibility by the means test. In addition, a randomly selected comparison group of households with adolescents age 16–17 years who were not receiving the CSG were also sampled in these PSUs.[3]

The survey was fielded between October 2010 and March 2011. One questionnaire gathered data from the entire household and another focused in depth on the sampled (focal) child. In addition, a confidential, self-administered survey was completed by adolescents (in a private room) to gather sensitive information, after which the survey was sealed and handed to the field researcher. Together, these survey instruments collected detailed information on household wealth, demographic structure, caregiver, and other household characteristics; CSG application, enrollment, and access; use of the CSG by the household and the adolescent; children's schooling, labor and time allocation, participation in risky behaviors, and many more variables.

The resulting sample consisted of 1,726 adolescents, including 876 (50.75%) in the target group of 15–16-year-old CSG beneficiaries (or 85.9% of the 1,020 targeted) and 850 (49.25%) in the comparison group of 16–17-year-olds not receiving the CSG (or 83.3% of the intended subsample). Of these 1,726 adolescents, 89% (1,531) completed the self-administered, confidential survey. Analysis of the comparison group of adolescents not receiving the CSG showed that almost half of this subgroup had received the CSG at some point in the past. And among the 439 adolescents in the comparison group who were never CSG beneficiaries, the heads of household had more income from work and were more highly educated, with 22% of household heads possessing an education level of 12 years or higher compared to about 8% of household heads for adolescents with CSG receipt. Because this subgroup of comparison adolescents with no CSG receipt ever was more advantaged in ways for which we had limited ability to adjust, we were left with an insufficient number of adolescents around the age eligibility cutoff to enable good matches in a regression discon-

[2] The study PSUs were designed to capture the full range of options through which beneficiaries could collect the CSG, including bank pay points, cash pay points, and cash pay point bundles. Population subgroups served via these CSG delivery options differ significantly in size, however, with the result that a small fraction of our sample (approximately 10%) have weights as much as 100 times those of other observations. Given the potential for these high weights to skew our results, we present the results of our analyses using the unweighted data.

[3] Additional details on the sampling strategies, surveys, and survey administration can be found in DSD, SASSA, and UNICEF (2012).

tinuity analysis. We therefore excluded adolescent cases from the sample that had never been beneficiaries and shifted to an impact estimation strategy that uses the variation in the length and timing of current or past CSG receipt among adolescents to evaluate the program's effects.[4]

Grant Receipt (Treatment) among Adolescents

Because our analysis is focused on adolescents who had a caregiver who received the CSG at some time in their lives (even if not at the time of the survey), our measures of treatment are constructed to capture "dose," or the number of months the adolescent was exposed to or could benefit from cash transfer receipt. As expected, the age at which adolescents first began receiving the CSG is strongly correlated with the length of time the CSG is received. Figure 2*a* shows the age at which adolescents first began receiving the CSG, stratified by whether the adolescent was receiving the CSG during adolescence. This graph illustrates the substantial variation in the timing at which the CSG was first received.

What this graph does not reveal, however, is the additional variation in grant receipt among the sampled adolescents because of interruptions and disconnections from the CSG after enrolment. Analysis of both SASSA data and information from the household survey that asked whether receipt of the CSG had ever been interrupted indicated that 60% of all adolescents in this sample had experienced an interruption in CSG receipt (or permanent disconnection) at some point. The average "dose loss" among the sampled adolescents was approximately 20 months of cash transfer receipt, and among those whose grants were stopped in error, the average loss of benefits was considerably higher, at over 30 months. Accounting for these interruptions and disconnections reduces the sample size to 927 adolescents (459 males and 468 females), as some of the detailed information on grant receipt included dates that were contradictory or chronologically improbable.[5] Figure 2*b* shows the total number of months the CSG was received, accounting for any interruptions or disconnections in grant receipt, stratified by gender. The dosage patterns are fairly similar for males and females. Table 1 presents descriptive statistics for all measures used in this study by gender of the adolescent, including adolescent and household characteristics, treatment measures, and adolescent outcomes.

[4] This study, like others to date that attempt to evaluate the causal impacts of the South African CSG (see also Agüero et al. 2007; Eyal and Woolard 2011), lacks a verifiable source of exogenous variation in treatment, and thus we necessarily rely on assumptions that cannot be fully validated.
[5] Descriptive statistics did not uncover any statistically significant differences between the sample of adolescents with and without the improved measures of CSG dose. These results are available on request from the authors.

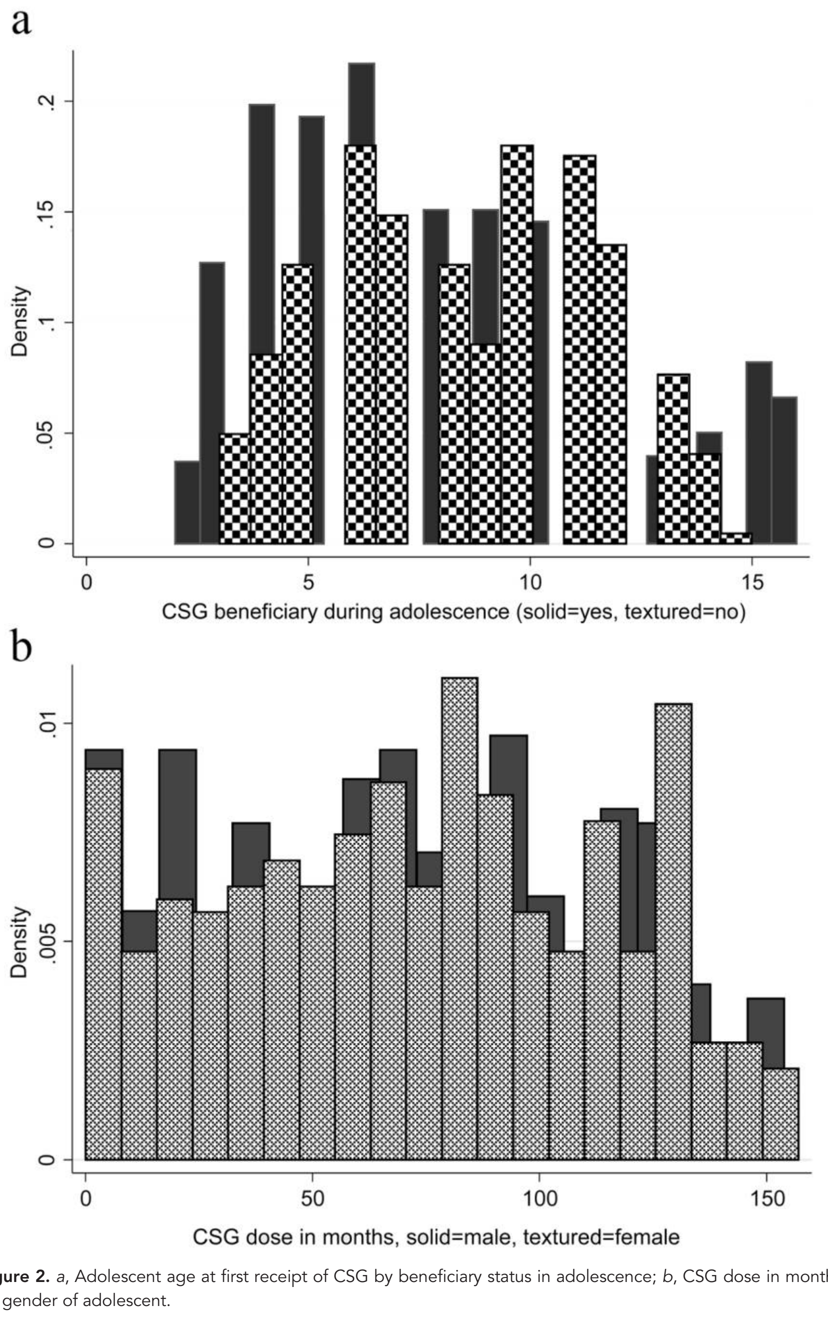

Figure 2. *a*, Adolescent age at first receipt of CSG by beneficiary status in adolescence; *b*, CSG dose in months by gender of adolescent.

TABLE 1

DESCRIPTIVE STATISTICS FOR STUDY MEASURES (BY GENDER)

	Females with CSG Receipt			Males with CSG Receipt		
	N	Mean	SD	*N*	Mean	SD
Adolescent and household characteristics:						
Age at first grant receipt	467	7.968	3.434	459	8.155	3.531
Age at time of survey	468	15.891	.713	459	15.856	.700
HH education:						
K–5	468	.250	.433	459	.237	.426
6–8	468	.265	.442	459	.242	.429
9–11	468	.278	.448	459	.216	.412
12+	468	.079	.270	459	.100	.301
HH disabled	468	.096	.295	459	.081	.273
HH chronically ill	468	.444	.497	459	.403	.491
HH age	467	50.452	12.364	456	51.009	12.531
HH female	468	.635	.482	459	.660	.474
HH not African	468	.081	.273	459	.092	.289
All household income from CSG	468	.150	.357	459	.161	.368
Rural	468	.404	.491	459	.403	.491
Periurban	468	.250	.433	459	.272	.446
Informal setting	468	.068	.253	459	.074	.262
Gauteng	466	.242	.429	459	.231	.422
Eastern Cape	466	.157	.364	459	.139	.347
Western Cape	466	.159	.366	459	.111	.315
Limpopo	466	.086	.280	459	.092	.289
Adol. not aware of eligibility	468	.109	.312	459	.109	.312
Adol. encouraged caregiver to apply	468	.278	.448	459	.270	.445
Adol. knowledge of formal sources	468	.182	.386	459	.192	.394
Adol. knowledge of informal sources	468	.577	.495	459	.510	.500
Adol. knows eligible age	468	.085	.280	459	.115	.320
Mother applied	468	.718	.450	459	.621	.486
Reapplied because of change in eligibility	468	.348	.477	459	.362	.481
Number of times reapplied	468	.801	1.877	459	.719	1.160
Document problems	468	.053	.225	459	.046	.209
Hours waited reapplying	468	1.205	2.392	458	1.225	3.202
Household distance to social welfare office	465	6.626	11.617	458	6.428	11.607
HH knows eligible age	468	.038	.193	459	.044	.204
HH knowledge of formal sources	468	.404	.491	459	.405	.491
Treatment measure:						
Never interrupted	468	.408	.492	459	.390	.488
Received CSG in adolescence	468	.679	.467	459	.684	.465
CSG dose (accounting for interruptions/ disconnections)	468	73.953	41.530	459	71.804	42.816
Adolescent outcome:						
No sexual debut	371	.906	.293	332	.822	.383
Never used drugs	422	.791	.407	398	.696	.461
Never drank alcohol	432	.704	.457	421	.644	.479
Age at first alcohol use	386	.777	1.748	360	.906	1.832
No criminal activity	394	.766	.424	371	.693	.462
No gang activity	390	.964	.186	344	.936	.245
Number of sex partners	346	.234	.872	326	.396	.967
Ever pregnant	282	.067	.251			
Highest grade attained	465	9.241	1.253	456	8.840	1.443

Note. HH = household head.

Outcomes and Mechanisms for Producing Them

Past studies have found effects of the CSG on school attendance, nutrition and child hunger, child labor (measured in hours children spent collecting water and fuel), and labor force participation in the household (see a discussion of these studies in Samson et al. 2011). However, this study is one of the first to look in greater detail at the potential effects of South Africa's CSG on adolescent risky behaviors. In addition, it examines the role of cash transfers in reducing risky behaviors in a fully scaled up cash transfer program, allowing for insights into some of the challenges of program implementation, such as those involved in getting children enrolled early and maintaining their connection to the grant. As discussed above, there is increasing evidence that risky behaviors can be mitigated by interventions such as cash transfer programs that disrupt the link between poverty and participation in risky behaviors (Robinson and Yeh 2009; Pettifor et al. 2012). The qualitative field research that preceded the administration of household and adolescent questionnaires in the CSG evaluation generated important information about how cash transfers might play a role in reducing risky behaviors such as transactional sex among adolescents. For example, the fieldwork report (DSD, SASSA, and UNICEF 2011) described accounts of teenage girls dating older men in order to obtain cash, food, clothing, gifts, and transport in which at times the gifts also extended to the family (e.g., a partner buying groceries for the household) or even in which adults in the household had facilitated sexual relationships between a child in their care and older men because of the financial benefit to the household or caregiver. Although the qualitative research also identified other social or psychological drivers of these relationships, the research team determined that "primarily, adults and adolescents describe these relationships in stark economic terms" (7), and community members believed that receiving the grant in adolescence could have some protective effect, including from some of the related risks of drug and alcohol use.

Pettifor et al. (2012) also point out that who in the household receives the cash transfer is likely a factor in its effects on behavior. They find in one pilot study that young women with access to their own income were able to make safer choices in sex partners, regardless of whether the cash transfer included conditions, and that these young women were less likely to have older partners or sex in exchange for money. The surveys fielded in our study asked households and adolescents about who received the CSG and how it was spent by household members. In South Africa, the cash transfers are paid primarily to a female caregiver, and the qualitative study (DSD, SASSA, and UNICEF 2011) confirmed that men were given very little access to the grant money. In the household survey, 90% of the households indicated that they spent the transfer primarily on the eligible child, and 76% reported giving "pocket money" to the adolescent from the CSG in the last month. In fact, the qualitative research described the adolescents as having "access and power to demand or negotiate" a share of the CSG (49)—that is, adolescents were aware of their "right" to the grant, as illustrated by this quote from one mother/caregiver about her adolescent son: "'Mom, don't forget that the 1st is pay day, there is something at the shops and I need it, so put me on the budget.' If I say: 'I don't have money', he will tell me: 'You will use my CSG money'" (49; Gauteng parent/caregiver focus group 7).

In the adolescent survey, 69% of both female and male adolescents indicated that they received some part of the CSG (typically less than one-half of the monthly cash transfer value) to spend on their own. Both household respondents and the adolescents indicated that their primary expenditures were on consumption (food), followed by educational expenses. The literature suggests that providing recipients with cash can increase their access to better food and educational opportunities, which in turn affects their preferences for healthier behaviors (Pettifor et al. 2012). The qualitative study of the CSG also noted that adolescent girls have fewer income-earning options than boys, especially in rural areas, and they were accordingly more likely to be driven to transactional sex by their poverty (DSD, SASSA, and UNICEF 2011).

The administration of the confidential survey to adolescents also yielded new data to quantitatively analyze the scope and implications of the risks to adolescents and the potential of the CSG to ameliorate them. In response to a question asking them to identify the main problems that teenagers face in their community, nearly two-thirds (65%) of South African adolescents in this sample identified pregnancy as a problem, followed by alcohol or drug use (accounting for another nearly 18% of the responses). Accordingly, we analyzed the effects of the CSG on the following risky behaviors: sexual debut, the number of sex partners, pregnancy, alcohol use, drug use, and selling drugs. We use an indicator variable, "never had sex," to measure whether the adolescent had made his or her sexual debut (i.e., equal to 1 if the adolescent never had sexual intercourse); the number of sex partners is an interval measure (and includes the value zero for those who are not sexually active), and pregnancy is an indicator of "ever pregnant." Male adolescents were about twice as likely as female adolescents to report having sexual intercourse (18% vs. 9.5%). More adolescents reported having a sexual partner than reported having sexual intercourse (21% for males and 12% for females); of those reporting a sex partner, 44% of adolescent males had more than one sex partner, compared to 27% of adolescent females. Alcohol use is measured as "never drank alcohol," and drug use as "never used drugs." About one-third of these adolescents had started drinking alcohol and another quarter had initiated drug use, but rates of alcohol and drug use were higher for males than females (see table 1). Finally, a relatively smaller fraction of adolescent males (5%) had engaged in selling drugs, and about 3% of adolescent females also reported selling drugs. In presenting the findings of the analysis below, we show the results separately for males and females.

Method and Model Specification

In assessing the effects of the CSG, a random assignment design was not feasible; it was prohibited by the South African constitution, and by 2011, enrollment of the target population was so high that it was difficult to find a sample of eligible children who were not currently or formerly enrolled (as we found in the fieldwork). In addition, we have to rely on a single, cross-sectional survey, combined with SASSA administrative data, for the analysis. At the same time, we know that CSG dosage and timing of benefit receipt (early vs. late) may matter for youth outcomes, where earlier (and presumably longer) grant receipt has been found to be associated with larger positive effects on schooling and health (De Janvry and Sadoulet 2006; Leroy, Ruel, and Verhofstadt 2009; DSD, SASSA, and UNICEF 2012; Heinrich, Hoddinott, and Samson 2013).

Because our estimation sample consists only of adolescents who were CSG beneficiaries at some point in their lives, we are not modeling selection into the CSG, but we still need to be concerned with the potential for selection bias in the timing and length of CSG receipt. The qualitative research that preceded the survey data collection provided the opportunity to probe for information about individuals' experiences with the CSG, how they became aware of program changes, the application process, any grant disruptions and household efforts to reapply, their interactions with the social welfare offices and related issues that might affect when the grant was first accessed, and how long the grant was received. The qualitative research findings, in turn, informed the design of the household and adolescent surveys with the explicit intention of empirically measuring factors that influenced selection into different levels (months) of CSG receipt and the timing (earlier or later in the child's life).

We address the problem of selection into levels or doses of treatment and the timing of treatment using propensity score matching (PSM), in which we construct a statistical comparison group by matching treated units to comparison units with similar values of the propensity to receive a given level of program benefits or to receive them at a particular time.[6] In assessing the effects of cash transfer dosage on program outcomes of interest, we use an extension of PSM—generalized propensity score matching (or GPS), developed by Hirano and Imbens (2004). In this approach, we adjust for selection into levels (number of months) of treatment and estimate a "dose-response function," where the dose is measured in months of cash transfers, and the response is the effect of that level of transfers on a given outcome of interest. Because the duration of CSG receipt is not a random variable, failing to control for factors that affect both the dosage of transfers received and the outcomes of interest would contribute to bias in this estimated relationship (i.e., violating the conditional independence assumption). As prior studies show linkages between cash transfer "dosage" and program effects (DSD, SASSA, and UNICEF 2012), we hypothesize that youth who have received more months of the CSG will have better outcomes.

Following Hirano and Imbens (2004), we define T as the set of all treatment levels (CSG receipt), where T is a specific treatment level (dosage), and the treatment interval is $[t_0, t_1]$, so that $T \in [t_0, t_1]$). We calculate the average dose-response function, $\mu(t) = E[Y(t)]$, assuming weak unconfoundedness; that is, after controlling for X, mean potential outcomes for comparison cases are identical to outcomes of adolescents who received T years of the grant. The GPS, R, is defined as $R = r(T, X)$, so that under this assumption and within strata with the same value of $r(T, X)$, the probability that $T = t$ does not depend on the value of X (Hirano and Imbens 2004). We estimate values of the GPS using maximum likelihood, assuming the treatment variable is normally distributed, conditional on the covariates X:

$$g(T)|X \sim N[h(\gamma, X), \sigma^2] : \check{R}_i = (2\pi\sigma^2)^{-0.5} \exp\{-(2\sigma^2)^{-1}[g(T_i) - h(\gamma, X)]\}. \tag{1}$$

We check the balancing properties by dividing the sample into four equal intervals (quartiles) based on the distribution of the treatment variable. We then divide each group into five blocks by the quintiles of the GPS using only

[6] All matching methods measure program effects as the average difference in outcomes for treated units minus a weighted average of outcomes for matched comparison units; after-matching balancing tests are used to assess the quality of the matches. The validity of this approach rests on two assumptions: (i) conditional mean independence—i.e., conditional on their observed characteristics, comparison group members have the same mean outcomes as the treatment group would have in the absence of the program—and (ii) sufficient common support (or overlap in the distribution of propensity scores for treatment and comparison group members) to produce valid matches (Rosenbaum and Rubin 1983).

the GPS distribution of households within that interval. Within those blocks, we calculate differences in means of covariates in X for adolescents in a given block compared to adolescents in the same group but in different blocks. In effect, we are testing whether covariate means of adolescents belonging to a given treatment-level group are significantly different from those of adolescents with a different treatment level but similar GPS (Kluve et al. 2012). The t-statistic of the differences in means between a given treatment-level group and all other groups (that indicates whether balance is achieved) is calculated as a weighted average over the five blocks in each treatment-level group. The dose-response function, which we present in tables as well as graphically, is estimated as the average potential outcome at specified levels of treatment (CSG receipt), with bootstrap methods used to calculate standard errors and confidence intervals.

In assessing the implications of the timing of CSG receipt, we use PSM, where "treatment" is an indicator equal to one if the child receives the CSG during adolescence and zero if the adolescent is not receiving the grant in adolescence. In this analysis, we exact match on adolescents' dosages of grant receipt (and match on other variables as described below) and then estimate the effects of receiving the grant in adolescence on risky behaviors. We hypothesize that among adolescents with the same total dosages of the CSG, those who receive the grant in adolescence will have more favorable outcomes (i.e., lower rates of risky behavior).

First-Stage Estimation of Grant Receipt

Anticipating the data demands of a nonexperimental evaluation and the importance of thoroughly understanding selection into levels and timing of grant receipt, the household and adolescent surveys (informed by the qualitative study) were designed to collect information that could be used to predict treatment levels, in addition to grant access. These variables included adolescent and household demographic characteristics; measures of their awareness and knowledge of the CSG eligibility criteria (including the age of eligibility that rose over time); and caregiver efforts to apply (and reapply), transaction costs such as time spent waiting to reapply and document requirements, and geographical measures. In analyzing the effects of varying CSG dosages (among grant recipients), these variables entered into the first-stage GPS model as described above. In PSM models, these same variables were used to predict grant receipt during adolescence.

Table 2 shows which factors were found to be important predictors of months of cash transfer receipt. We present the results separately for male and female adolescents, although a Chow test (test statistic reported in table 2) suggests that

TABLE 2
PREDICTING MONTHS OF CSG RECEIPT

	Male Adolescents			Female Adolescents		
Predictor	Coefficient	SE	*P*	Coefficient	SE	*P*
Age at first grant receipt	−9.883	.313	.000	−10.037	.280	.000
Age at time of survey	−7.999	1.588	.000	−9.090	1.380	.000
HH education:						
K–5	.534	3.577	.881	.098	3.273	.976
6–8	−3.400	2.392	.156	−.828	3.448	.810
9–11	−5.866	3.360	.082	2.657	3.715	.475
12+	2.750	2.527	.277	−6.002	4.615	.194
HH disabled	9.223	3.326	.006	−5.891	3.237	.069
HH chronically ill	6.627	3.448	.055	−.469	2.100	.823
HH age	7.611	3.833	.048	.038	.091	.675
HH female	7.388	4.541	.105	−.338	2.015	.867
HH not African	8.056	4.162	.054	2.199	3.952	.578
All income from CSG	−3.602	2.418	.137	.829	2.708	.760
Rural	4.776	3.613	.187	−.033	3.030	.991
Periurban	1.735	1.553	.265	−4.472	2.812	.112
Informal settlement	−9.608	5.820	.100	−12.091	4.095	.003
Gauteng	−1.285	.397	.001	.747	2.798	.790
Eastern Cape	.088	.108	.414	1.234	2.899	.670
Western Cape	−2.883	2.356	.222	−8.902	3.370	.009
Limpopo	.934	4.262	.827	−2.800	3.754	.456
Adolescent not aware of eligibility	1.608	3.361	.633	−3.011	3.220	.350
Adolescent knowledge of informal sources	3.279	3.157	.300	−1.590	1.967	.419
Adolescent knows age of eligibility	2.231	4.665	.633	−3.420	3.475	.326
Mother applied	3.483	3.069	.257	1.322	2.149	.539
Ever reapplied	−2.522	3.152	.424	3.050	2.884	.291
Number of times reapplied	−1.077	3.415	.753	−.980	.625	.118
Document problems	−7.417	4.456	.097	−1.367	4.488	.761
Hours waited reapplying	−11.816	4.195	.005	.121	.523	.817
Constant	271.229	26.213	.000	300.503	22.644	.000
N		455			464	
R^2		.7278			.7763	

Note. Chow test for differences between males and females, $F = 1.337$. HH = household head.

the various factors predicting months of grant receipt for males and females were not (statistically significantly) different. The results show that getting access to the grant at a later age and being older at the time of the 2011 survey were the strongest predictors of total months of grant receipt; as expected, those who started receiving the grant later in their childhood had significantly lower "doses" of grant receipt (i.e., approximately 10 months less for each year later they started). There is little relationship between the household head's education level and months of grant receipt; however, male adolescents with a disabled household head received the grant for 9 months longer on average. Male and female adolescents from informal settlements received substantially fewer months of grant receipt on average (almost 10 months fewer for males and about 12 months fewer for females), although female adolescents from one of the relatively better off provinces, Western Cape, also had significantly lower CSG dosages (9 months less) than those from the reference province, KwaZulu Natal (a relatively poorer province). A few factors associated with the implementation of the CSG, which could vary both within and across social welfare offices and communities, were also statistically significant determinants of the number of months of cash transfers received by male adolescents. Each hour spent waiting to reapply for the CSG (implying some interruption had occurred) reduced male adolescent's cash transfer receipt by more than 11 months, while problems producing documentation at application reduced their grant receipt by more than 7 months on average.

Together, these factors explained about three-fourths of the variation in CSG receipt among adolescents in this sample. It is this variation that we draw on estimating the effects of different levels of treatment (i.e., CSG doses), although we acknowledge that we are primarily identifying associations rather than causal effects, given the potential for omitted variable bias in estimating selection into different levels of treatment (or months of cash transfers).

Relationship between Cash Transfer Receipt and Adolescent Risky Behaviors, CSG Dosage, and Adolescent Sexual Debut and Sexual Partners

GPS models were estimated to explore the relationship between months of CSG receipt and abstinence from sexual intercourse. We show these results separately for females and males in figures 3*a* and 3*b*, respectively, and in table 3. Table 3 presents the dose-response effects from the GPS estimation, where for a specific level of CSG grant receipt—ranging from 10 to 150 months, in 10-month increments—it shows the predicted probability that an adolescent had not made his or her sexual debut. On the basis of these estimates, as well as from eyeballing the graphical display of results in figures 3*a* and 3*b*, it is clear that adolescent females are overall more likely to refrain from sexual intercourse than males, and their sexual debut appears to be considerably more sensitive to grant receipt. While the relationship between months of cash transfer receipt and sexual debut is basically flat (no effect) for adolescent males, the probability that females report that they had not made their sexual debut is (statistically) significantly higher as months of CSG receipt increase, rising steadily from 0.843 to 0.973 at the highest levels of CSG receipt. Tests of equality of the predicted effects at 30 months of CSG receipt versus 40, 50, 60, 70, 80, 90, 100, 110, 120, and 130 months of CSG receipt confirmed that starting at 50 months, the responses (probability of no sexual debut) were significantly different at these different levels of treatment ($t = -2.55, p < .014$ for 30 vs. 50;

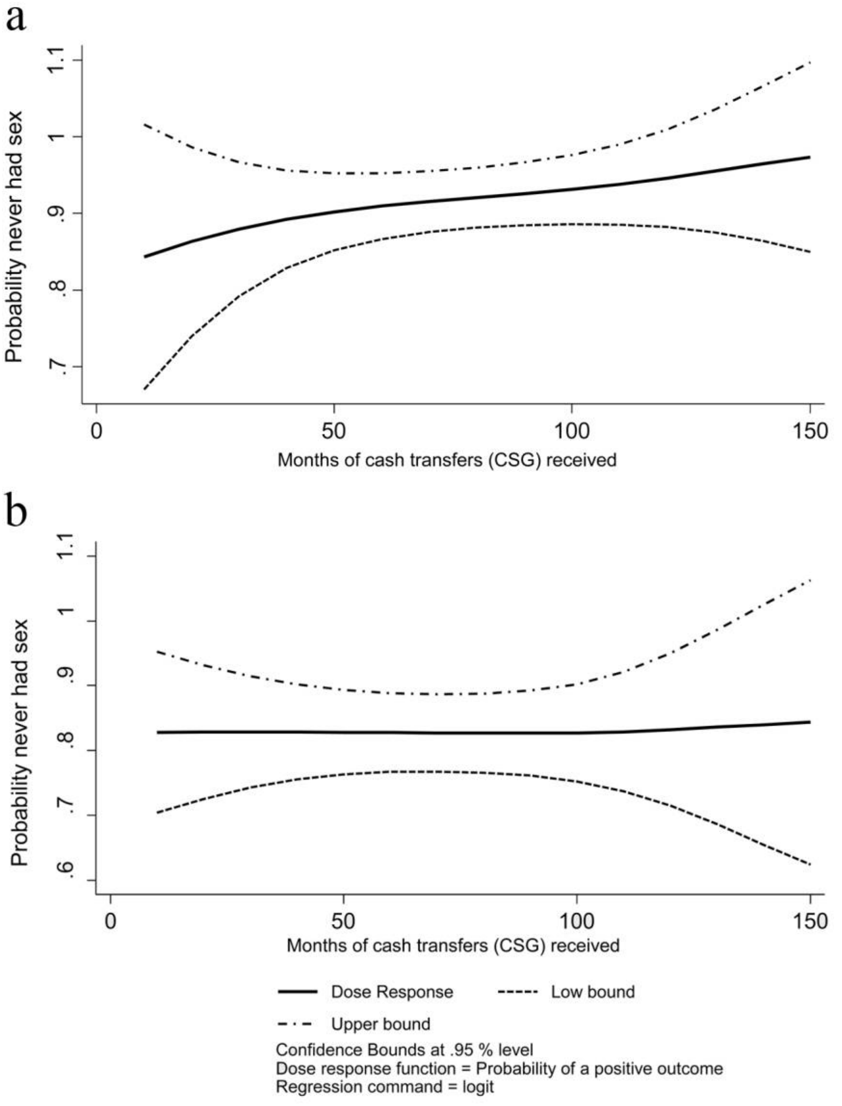

Figure 3. Relationship between CSG dose and abstinence from sexual activity for adolescent females (*a*) and adolescent males (*b*).

$t = -7.02$, $p < .0001$ for 30 vs. 130).[7] These findings suggest a potentially important role for cash transfers in reducing the likelihood of sexual debut (engagement in sexual intercourse) among female adolescents.

[7] Because the number of observations is sparser at the lowest and highest levels of cash transfer receipt, we conduct these tests of equality at dosage levels at which there is greater density of observations and point estimates are more precise. Full details on the results of these tests are available from the authors. Still, we generally suggest exercising caution in using the point estimates, particularly from parts of the dose-response curve where the bounds (confidence intervals) are widest.

TABLE 3
ESTIMATED DOSE-RESPONSE (EFFECTS) OF CSG RECEIPT ON ADOLESCENTS' PROBABILITY OF NO SEXUAL DEBUT

Months of CSG Received	Females		Males	
	Effect Estimate	SE	Effect Estimate	SE
10	.843	.088	.828	.063
20	.863	.063	.829	.053
30	.879	.045	.829	.044
40	.892	.033	.829	.037
50	.902	.026	.828	.033
60	.909	.022	.828	.031
70	.915	.020	.827	.030
80	.920	.020	.827	.031
90	.925	.021	.827	.033
100	.931	.023	.827	.038
110	.938	.027	.829	.047
120	.946	.033	.832	.060
130	.955	.041	.836	.076
140	.965	.052	.840	.094
150	.973	.063	.844	.112

Note. Results of generalized propensity score matching analyses. See fig. 2*b* for sample sizes within each treatment (dosage) bin.

We also examined the relationship between months of CSG receipt and the number of sexual partners adolescents had, and here we found similar patterns in results for males and females. Table 4 and figures 4*a* and 4*b*, respectively, report these results for female and male adolescents (including those in the

TABLE 4
ESTIMATED DOSE-RESPONSE (EFFECTS) OF CSG RECEIPT ON ADOLESCENTS' NUMBER OF SEX PARTNERS

Months of CSG Received	Females		Males	
	Effect Estimate	SE	Effect Estimate	SE
10	.140	.116	.615	.309
20	.131	.090	.579	.252
30	.126	.069	.544	.204
40	.123	.053	.511	.167
50	.120	.043	.481	.139
60	.114	.036	.452	.120
70	.104	.033	.425	.108
80	.088	.032	.400	.104
90	.064	.033	.378	.110
100	.031	.039	.360	.129
110	−.013	.052	.345	.165
120	−.069	.073	.332	.220
130	−.135	.104	.319	.289
140	−.203	.140	.303	.366
150	−.266	.179	.283	.442

Note. Results of generalized propensity score matching analyses. See fig. 2*b* for sample sizes within each treatment (dosage) bin.

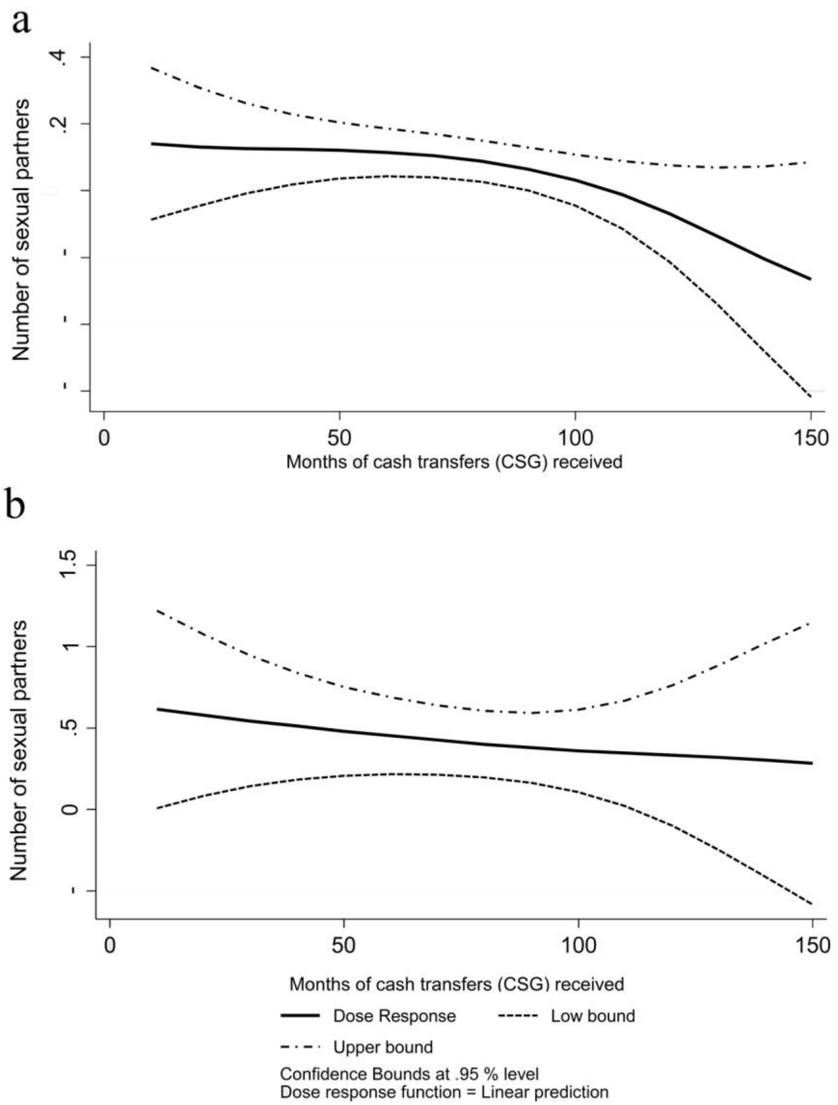

Figure 4. Relationship between CSG dose and number of sexual partners for adolescent females (*a*) and adolescent males (*b*).

sample who reported having zero sex partners). The results show a steady decline in the number of sexual partners for adolescents as months of CSG receipt increase. For females, the predicted number of sexual partners turns negative at 110 months of grant receipt (and above), and the error bounds get very wide (and the dose response estimates are not statistically significant), so we disregard those estimates.[8] Still, if a greater number of sexual partners is more likely to be linked to transactional sex, then it appears that these findings are consistent with the explanation that cash transfers might play a role in reducing this type of risky behavior among adolescents by reducing financial need in the household. Tests of equality of the predicted effects for females become statistically significant when comparing 30 versus 70 months of CSG receipt ($p = .05$) and are statistically significant and increasingly larger through the comparison of 30 versus 100 months of CSG receipt ($t = 7.02$, $p < .0001$). For males, the tests of equality of the predicted effects first become statistically significant when comparing 30 versus 60 months of CSG receipt ($p = .012$) and are statistically significant and increasingly larger as well through the comparison of 30 versus 100 months of CSG receipt ($t = 4.68$, $p < .0001$).

CSG Effects on Adolescent Alcohol and Drug Use and Selling of Drugs

The results of the GPS estimation of the relationship between months of cash transfer receipt and abstinence from alcohol and drugs did not show any statistically significant relationships. For females, the dose-response estimates steadily predict, across the different levels of grant receipt, that approximately 70% of female adolescents abstain from alcohol use. For males, the GPS dose-response estimates also show a fairly straight line, predicting that regardless of the level of grant receipt, about 60%–63% of male adolescents abstain from alcohol use. The GPS results similarly showed a lack of an association between cash transfer receipt and drug use for both male and female adolescents, and thus, for brevity, we do not present these results graphically (for alcohol or drug use) here.

However, we did see an association between cash transfer receipt and engagement in selling drugs by adolescent males. The results of this GPS analysis for both males and females are shown in table 5 and figures 5*a* and 5*b*, although only the results for males show a statistically significant association. For male adolescents, the probability of having ever sold drugs declines from 0.139 to 0.051 as months of cash transfer receipt increases. Tests of equality of the predicted effects become statistically significant starting with the comparison of 30 versus 50 months of CSG receipt ($p = .016$) and are statistically significant and increasingly larger through the comparison of 30 versus 100 months of CSG receipt ($t = 4.70$, $p < .0001$). If adolescent males' participation in selling drugs is also motivated by poverty and financial need in the

[8] We tried transformations of the dependent variable (number of sexual partners) and alternative specifications, although it is not possible to estimate a count data model with GPS. In addition, the small sample size of adolescents when restricted to only those with some sexual activity precludes the estimation of the effects of CSG dosage on number of sexual partners for the subsample of sexually active adolescents.

TABLE 5
ESTIMATED DOSE-RESPONSE (EFFECTS) OF CSG RECEIPT ON ADOLESCENT EVER SOLD DRUGS

Months of CSG Received	Females		Males	
	Effect Estimate	SE	Effect Estimate	SE
10	.044	.042	.139	.086
20	.039	.032	.121	.064
30	.034	.026	.105	.048
40	.030	.022	.093	.038
50	.028	.020	.082	.032
60	.027	.019	.074	.029
70	.027	.018	.068	.028
80	.029	.019	.063	.029
90	.033	.021	.061	.032
100	.038	.025	.059	.037
110	.043	.032	.059	.046
120	.047	.043	.058	.059
130	.048	.059	.057	.075
140	.044	.081	.054	.093
150	.037	.106	.051	.112

Note. Results of generalized propensity score matching analyses. See fig. 2*b* for sample sizes within each treatment (dosage) bin.

household, it seems plausible that receipt of the CSG could contribute to a reduction in engagement in this risky behavior. The qualitative field research suggested the likelihood of financial motivations for adolescents' involvement in selling drugs, as exemplified by this quote from a focus group participant: "There are older people who send this kid to sell drugs. You will see your child no longer wants to stay at home but is always on the street. These kids, they go for it because they want money" (DSD, SASSA, and UNICEF 2011, 57).

Timing of Cash Transfer Receipt and Effects on Adolescent Risky Behavior

In a final set of analyses, we explore the implications of the timing of CSG receipt (i.e., of receiving the CSG during adolescence) on adolescent engagement in these risky behaviors. The receipt of the CSG in adolescence was made possible by increases in the age of CSG eligibility, starting in 2006 up to age 14 and all the way up to age 18 by 2012 (as shown in fig. 1). We hypothesize that adolescents who were receiving the grant during adolescence would be less likely to engage in risky behaviors.

In these analyses, we employ PSM with exact matching and a nearest neighbor strategy to examine the implications of the timing of grant receipt. We exact match on actual dosages of grant receipt (i.e., comparing those who receive the CSG for the same number of months during the course of their childhood) and then estimate the effects of receiving the grant while an adolescent on outcomes associated with risky behaviors. We estimate these models separately

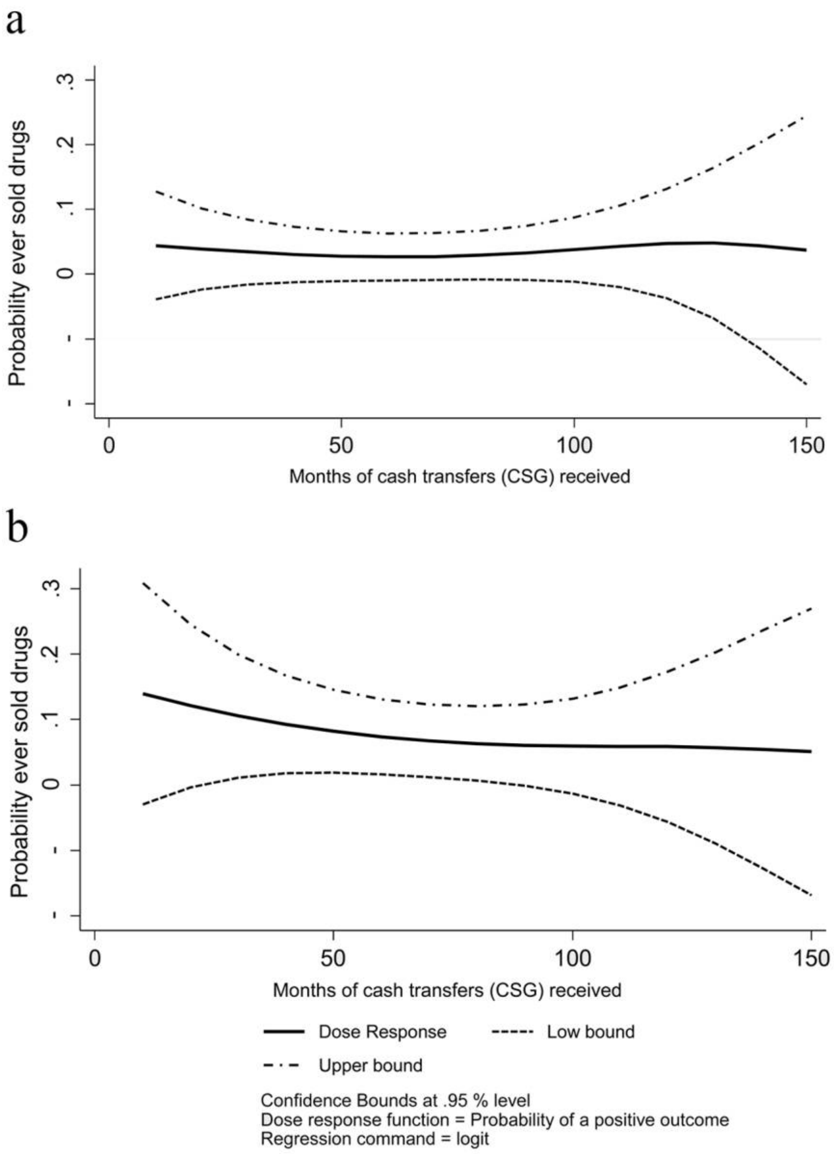

Figure 5. Relationship between CSG dose and ever sold drugs for adolescent females (*a*) and adolescent males (*b*).

for males and females and adjust the tolerance band (or caliper) in the matching procedure to ensure that we have exact matches on dose per month for all cases in the estimation sample, as required by the matching technique we use.[9]

[9] We estimate these models using the teffects command in Stata with nearest neighbor matching. The teffects command has an advantage over psmatch2 in that it takes into account the fact that propen-

Table 6 presents the results of these analyses, which show the differences in outcomes for adolescents who were receiving the grant in adolescence compared to those who were not receiving the grant in adolescence (adjusting via exact matching for total months of grant receipt). For females, receiving the grant in adolescence is associated with a (statistically) significantly higher probability (11 percentage points) that they have not made their sexual debut. In addition, the number of sexual partners female adolescents had is lower by about one-third when they received the CSG in adolescence. We also estimated the probability that female adolescents had ever been pregnant, and the results in table 6 show that the probability of having ever been pregnant is about 10.5 percentage points lower if the CSG was received in adolescence. The patterns for the other outcomes for females all suggest that cash transfer receipt in adolescence is associated with lower rates of risky behaviors (i.e., higher rates of abstinence from alcohol and drugs and a lower probability that females engaged in selling drugs), although these estimates are not statistically significant.

For males, receiving the grant in adolescence also predicts lower rates of engagement in risky behaviors, but only the likelihood that they refrain from alcohol use is a statistically significant association (i.e., predicting a higher rate of abstinence by about 12 percentage points). Together, these findings seem to suggest that beyond the relationship between dosage and adolescent outcomes, receiving the CSG in adolescence might provide some additional protection from engagement in risky behaviors during the teenage years.

Balancing Test Results, Bounds from Partial Identification Methods, and Limitations

For all of the matching analyses, after-matching balancing tests were performed to assess statistical equivalence across adolescents in the treatment and comparison states. Balance was achieved for all covariates in the PSM nearest neighbor matching analysis of the effects of the timing of CSG receipt.[10] Covariate balance in the GPS analyses generally fared well, although at the extreme ends of the distribution of months of cash transfer receipt, there was some imbalance in matching on the age at first receipt of the CSG. In addition, there were a few other covariates that did not balance in one or more of the treatment intervals; table A1 provides a summary of these results and identifies the covariates that

sity scores are estimated rather than known in calculating the standard errors. It also has a disadvantage in that there is no postestimation command for checking after-matching balance of the covariates. We handle this by estimating the same model with psmatch2, although we only match (rather than exact match) on the dose per month, and we obtain balance after matching for all covariates.

[10] Detailed results of the PSM balancing tests are available on request from the authors.

TABLE 6

EFFECTS OF RECEIVING THE CSG IN ADOLESCENCE ON ADOLESCENT RISKY BEHAVIORS

Outcome	Difference (ATE)	SE	*P*
Females:			
No sexual debut	.111	.043	.010
Number of sex partners	−.337	.136	.013
Ever pregnant	−.105	.043	.014
Never drank alcohol	.049	.054	.366
Never used drugs	.039	.050	.447
Ever sold drugs	−.021	.026	.403
Males:			
No sexual debut	.033	.052	.525
Number of sex partners	−.175	.111	.117
Never drank alcohol	.124	.058	.034
Never used drugs	.024	.067	.724
Ever sold drugs	−.018	.029	.538

Note. Results of propensity score matching analyses with exact matching on CSG dose. Treatment = adolescents received CSG in adolescence. ATE = average treatment effect. Sample sizes vary by outcome (see table 1).

did not balance in a given treatment interval. Given the number of covariates included in the models (25), it is possible that some of these statistically significant differences (identified in the balancing tests) are due to chance (i.e., random error).

We also used partial identification methods developed by Manski and Pepper (2000) and approaches to applying them demonstrated by Kreider et al. (2012) and McCarthy, Millimet, and Roy (2015) to estimate the effects of receiving the CSG in adolescence under less stringent assumptions than are required for generating point estimates. We are particularly interested in whether the bounds on our parameter of interest include zero (in varying specifications for their estimation). Because this method requires both binary treatment and binary outcome measures, we can only generate these bounds for our estimates of the effects of receiving the CSG in adolescence (where the treatment = 1 if the CSG was received in adolescence) and for adolescent outcomes that are binary. Thus, we estimated these bounds for the two statistically significant outcomes for females that meet these requirements (i.e., have not made their sexual debut and ever pregnant), and for the one statistically significant binary outcome for males (abstinence from alcohol), as shown in table 6. We used the number of months of CSG receipt (subdivided into three groups or cells for calculating the bounds) as the monotone instrumental variable (MIV), which assumes that the latent probability of a good outcome conditional on treatment assignment varies (weakly) monotonically with this variable. We performed these analyses with each possible specification: monotone treatment selection (MTS) both positive and negative, monotone treatment response

(MTR), and the combinations MTS and MTR; MIV and MTS; and MIV, MTS, and MTR.

Table A2 presents the results of the bounds estimation for the three outcomes and six alternative specifications and varying assumed rates of measurement error in the outcome (1%, 2%, 5%, and 10%). For the outcomes of no sexual debut and no alcohol consumption, we present the results of MTS with negative selection, and for the outcome ever pregnant, we present the results of MTS for positive selection (as most applicable). The estimated bounds generated under the various assumptions (MTS; MTS and MTR; MIV and MTS; and MIV, MTS, and MTR) lend support to our interpretation of these estimated effects as not spurious. That is, in nearly every specification, the bounds do not include zero, and invoking the monotonicity assumptions (including monotone treatment response) tightens the bounds, as expected.

Although we believe these tests and bounds calculations suggest a positive association between CSG receipt and better outcomes in adolescence for South African youth, we want to reiterate that we are not arguing for a causal interpretation of the estimated effects, because of the possibility of unmeasured selection into treatment levels and given that balance is not achieved on all covariates used in predicting selection into levels of treatment.

Conclusion

This study presents suggestive evidence that cash transfer programs can play an important role in reducing risky behaviors among youth who are vulnerable or at risk because of their poverty, although we do not claim to have identified causal relationships between cash transfer receipt and youth risky behaviors in this study. Larger doses or durations of cash transfer receipt appear to have a greater protective effect for adolescent females, given the observed associations between CSG dosage and the likelihood that they delay their sexual debut and refrain from engaging in sex with multiple partners. The fact that both female and male adolescents who received the CSG for more months had fewer sexual partners might imply that the type of sexual activity being reduced is a riskier type (e.g., transactional sex). In addition, the association observed between increased CSG dosage and lower rates of engagement in selling drugs by adolescent males also suggests that financial need might be driving some of the participation in these risky behaviors and that cash transfers provided for adolescent children might therefore help to reduce the behaviors. And finally, controlling for the duration of treatment, grant receipt in adolescence appears to provide extra protection against a number of these risky behaviors, particularly for females.

These findings lend support to suggestive evidence in the literature that programs or interventions that are comprehensive—in this case, a cash transfer program that does not impose conditions or target particular behaviors—have potential to reduce exposure to multiple types of risks, such as those investigated in this analysis. These results are also notable because they appear to substantiate, as did the Malawi experimental study that compared conditional and unconditional cash transfer programs, that unconditional cash transfers may have important effects on female sexual behavior and adolescent pregnancies (Baird et al. 2011).

In this regard, the results imply support for recent policy changes made by the government of South Africa that have increased access to the CSG among the poorest households. Extending the age of eligibility for the CSG up to 18 years (when children become adults) has allowed many more economically disadvantaged adolescents the opportunity to receive cash transfers. In addition, other policy changes have simplified the application process and reduced onerous requirements that had limited take-up in very poor areas and led to unintended interruptions and disconnections from the grant, as well as to lower overall months of grant receipt (Delany et al. 2008; Heinrich and Brill 2015). The results of this study suggest that these policy efforts to expand grant access to children up to adulthood and to reduce barriers to maintaining grant access while poor should improve outcomes for South African adolescents.

Finally, the findings of this study present a concern for adolescents who first began receiving the CSG in the middle age range of childhood and were less likely to be in households receiving the CSG at the time of adolescence. It is plausible that this observed pattern of access to the CSG may be a policy implementation artifact, possibly related to the changes in the age of eligibility for the CSG over time, in which some youth were not reached at an early age and also did not stay connected with the CSG through their teenage years because of lack of information or outreach. Further exploration of this pattern of grant access showed that adolescents in Limpopo and Eastern Cape, followed by Kwa-Zulu Natal (the three poorest provinces), had significantly lower rates of current CSG receipt for adolescents who first began receiving the CSG between age 10 and 13 years. An important policy implication that follows from this study is that greater efforts should be made to ensure continuous access to the CSG by households with eligible children through adolescence, so that the potential benefits of the cash transfer program may be fully realized.

Appendix

TABLE A1
RESULTS OF AFTER-MATCHING BALANCING TESTS FOR GPS ANALYSES

	Females		Males	
Treatment Interval	Covariates Balanced	Covariates Not Balanced	Covariates Balanced	Covariates Not Balanced
1 [0, 41 months]	23/25	Age at CSG start, Eastern Cape (province)	25/25	
2 [44, 72 months]	24/25	Gauteng (province)	25/25	
3 [73, 108 months]	24/25	Document problems	23/25	Adolescent not aware of age of eligibility, female household head
4 [109, 157 months]	24/25	Age at CSG start	24/25	Age at CSG start

Note. The four treatment intervals (based on the distribution of the treatment variable, CSG dose in months) are shown. There are 25 covariates included in each GPS estimation. The number of covariates that balance within each treatment interval are indicated, along with the covariates that do not balance. The assumption of normality was not satisfied at the $\alpha = .05$ level.

TABLE A2
RESULTS OF BOUNDS ESTIMATION

Error Rate	Arbitrary Errors		No False Positives	
Females (outcome = has not made her sexual debut):*				
Exogenous selection model:				
0	[.150,	.150] p.e.	[.150,	.150] p.e.
.01	[.116,	.184] p.e.	[.116,	.156] p.e.
.02	[.082,	.219] p.e.	[.082,	.162] p.e.
.05	[−.021,	.280] p.e.	[−.021,	.181] p.e.
.1	[−.198,	.309] p.e.	[−.198,	.217] p.e.
No monotonicity assumptions (worst case selection):				
0	[−.429,	.571] p.e.	[−.429,	.571] p.e.
.01	[−.439,	.581] p.e.	[−.439,	.581] p.e.
.02	[−.449,	.591] p.e.	[−.449,	.591] p.e.
.05	[−.479,	.621] p.e.	[−.479,	.621] p.e.
.1	[−.529,	.671] p.e.	[−.529,	.671] p.e.
MTS assumption (negative selection):				
0	[.150,	.571] p.e.	[.150,	.571] p.e.
.01	[.116,	.581] p.e.	[.116,	.581] p.e.
.02	[.082,	.591] p.e.	[.082,	.591] p.e.
.05	[−.021,	.621] p.e.	[−.021,	.621] p.e.
.1	[−.198,	.671] p.e.	[−.198,	.671] p.e.
MTS and MTR assumption (negative selection):				
0	[.150,	.571] p.e.	[.150,	.571] p.e.
.01	[.116,	.581] p.e.	[.116,	.581] p.e.
.02	[.082,	.591] p.e.	[.082,	.591] p.e.
.05	[.000,	.621] p.e.	[.000,	.621] p.e.
.1	[.000,	.671] p.e.	[.000,	.671] p.e.
MIV and MTS assumption (negative selection):				
0	[.150,	.274] p.e.	[.150,	.274] p.e.
	.013	.003 bias	.013	.003 bias
.01	[.116,	.285] p.e.	[.116,	.280] p.e.
	.013	.003 bias	.013	.003 bias

TABLE A2 (*continued*)

Error Rate	Arbitrary Errors	No False Positives
.02	[.082, .296] p.e.	[.082, .285] p.e.
	.013 .003 bias	.013 .003 bias
.05	[−.021, .330] p.e.	[−.021, .301] p.e.
	.006 .001 bias	.006 .003 bias
.1	[−.073, .364] p.e.	[−.069, .329] p.e.
	.000 .003 bias	.000 .003 bias
MIV, MTS, MTR assumption (negative selection):		
0	[.150, .274] p.e.	[.150, .274] p.e.
	.013 .003 bias	.013 .003 bias
.01	[.116, .285] p.e.	[.116, .280] p.e.
	.013 .003 bias	.013 .003 bias
.02	[.082, .296] p.e.	[.082, .285] p.e.
	.013 .003 bias	.013 .003 bias
.05	[.000, .330] p.e.	[.000, .301] p.e.
	.006 .001 bias	.006 .003 bias
.1	[.000, .364] p.e.	[.000, .329] p.e.
	.000 .003 bias	.000 .003 bias
Females (outcome = ever pregnant):†		
Exogenous selection model:		
0	[−.106, −.106] p.e.	[−.106, −.106] p.e.
.01	[−.143, −.070] p.e.	[−.110, −.070] p.e.
.02	[−.170, −.033] p.e.	[−.113, −.033] p.e.
.05	[−.181, .078] p.e.	[−.125, .078] p.e.
.1	[−.202, .158] p.e.	[−.147, .150] p.e.
No monotonicity assumptions (worst case selection):		
0	[−.559, .441] p.e.	[−.559, .441] p.e.
.01	[−.569, .451] p.e.	[−.569, .451] p.e.
.02	[−.579, .461] p.e.	[−.579, .461] p.e.
.05	[−.609, .491] p.e.	[−.609, .491] p.e.
.1	[−.659, .541] p.e.	[−.659, .510] p.e.
MTS assumption (positive selection):		
0	[−.559, −.106] p.e.	[−.559, −.106] p.e.
.01	[−.569, −.070] p.e.	[−.569, −.070] p.e.
.02	[−.579, −.033] p.e.	[−.579, −.033] p.e.
.05	[−.609, .078] p.e.	[−.609, .078] p.e.
.1	[−.659, .158] p.e.	[−.659, .150] p.e.
MTS and MTR assumptions (positive selection):		
0	[.000, −.106] p.e.	[.000, −.106] p.e.
.01	[.000, −.070] p.e.	[.000, −.070] p.e.
.02	[.000, −.033] p.e.	[.000, −.033] p.e.
.05	[.000, .078] p.e.	[.000, .078] p.e.
.1	[.000, .158] p.e.	[.000, .150] p.e.
MIV and MTS assumptions (positive selection):		
0	[−.381, −.106] p.e.	[−.381, −.106] p.e.
	.001 .007 bias	.001 .007 bias
.01	[−.392, −.070] p.e.	[−.386, −.070] p.e.
	.001 .006 bias	.001 .006 bias
.02	[−.400, −.038] p.e.	[−.392, −.038] p.e.
	.000 .003 bias	.001 .003 bias
.05	[−.424, .041] p.e.	[−.408, .040] p.e.
	.001 −.015 bias	.001 −.015 bias

TABLE A2 (*continued*)

Error Rate	Arbitrary Errors		No False Positives	
.1	[−.450,	.027] p.e.	[−.435,	.024] p.e.
	−.001	.005 bias	.001	.004 bias
	.005	.003 bias	.019	.003 bias
.1	[.000,	.147] p.e.	[.000,	.094] p.e.
	.003	.010 bias	.020	.010 bias
MIV, MTS, MTR assumptions (positive selection):				
0	[.000,	−.106] p.e.	[.000,	−.106] p.e.
	.001	.007 bias	.001	.007 bias
.01	[.000,	−.070] p.e.	[.000,	−.070] p.e.
	.001	.006 bias	.001	.006 bias
.02	[.000,	−.038] p.e.	[.000,	−.038] p.e.
	.000	.003 bias	.001	.003 bias
.05	[.000,	.041] p.e.	[.000,	.040] p.e.
	.001	−.015 bias	.001	−.015 bias
.1	[.000,	.027] p.e.	[.000,	.024] p.e.
	−.001	.005 bias	.001	.004 bias
Males (outcome = no alcohol use):‡				
Exogenous selection model:				
0	[.119,	.119] p.e.	[.119,	.119] p.e.
.01	[.095,	.144] p.e.	[.095,	.136] p.e.
.02	[.071,	.168] p.e.	[.071,	.152] p.e.
.05	[−.002,	.241] p.e.	[−.002,	.202] p.e.
.1	[−.132,	.370] p.e.	[−.132,	.295] p.e.
No monotonicity assumptions (worst case selection):				
0	[−.435,	.565] p.e.	[−.435,	.565] p.e.
.01	[−.445,	.575] p.e.	[−.445,	.575] p.e.
.02	[−.455,	.585] p.e.	[−.455,	.585] p.e.
.05	[−.485,	.615] p.e.	[−.485,	.615] p.e.
.1	[−.535,	.665] p.e.	[−.535,	.665] p.e.
MTS assumption (negative selection):				
0	[.119,	.565] p.e.	[.119,	.565] p.e.
.01	[.095,	.575] p.e.	[.095,	.575] p.e.
.02	[.071,	.585] p.e.	[.071,	.585] p.e.
.05	[−.002,	.615] p.e.	[−.002,	.615] p.e.
.1	[−.132,	.665] p.e.	[−.132,	.665] p.e.
MTS and MTR assumptions (negative selection):				
0	[.119,	.565] p.e.	[.119,	.565] p.e.
.01	[.095,	.575] p.e.	[.095,	.575] p.e.
.02	[.071,	.585] p.e.	[.071,	.585] p.e.
.05	[.000,	.615] p.e.	[.000,	.615] p.e.
.1	[.000,	.665] p.e.	[.000,	.665] p.e.
MIV and MTS assumptions (negative selection):				
0	[.119,	.237] p.e.	[.119,	.237] p.e.
	.032	.003 bias	.032	.003 bias
.01	[.095,	.248] p.e.	[.095,	.243] p.e.
	.029	.003 bias	.031	.003 bias
.02	[.071,	.260] p.e.	[.071,	.248] p.e.
	.028	.003 bias	.030	.003 bias
.05	[−.002,	.293] p.e.	[−.002,	.265] p.e.
	.035	.003 bias	.036	.003 bias
.1	[−.132,	.349] p.e.	[−.132,	.293] p.e.
	.007	.003 bias	.006	.003 bias

TABLE A2 (*continued*)

Error Rate	Arbitrary Errors		No False Positives	
MIV, MTS, MTR assumptions (negative selection):				
0	[.119,	.237] p.e.	[.119,	.237] p.e.
	.032	.003 bias	.032	.003 bias
.01	[.095,	.248] p.e.	[.095,	.243] p.e.
	.029	.003 bias	.031	.003 bias
.02	[.071,	.260] p.e.	[.071,	.248] p.e.
	.028	.003 bias	.030	.003 bias
.05	[.000,	.293] p.e.	[.000,	.265] p.e.
	.035	.003 bias	.036	.003 bias
.1	[.000,	.349] p.e.	[.000,	.293] p.e.
	.007	.003 bias	.006	.003 bias

Note. Treatment = beneficiary in adolescence. Number of pseudosamples used in MIV bias correction = 100.

* Number of observations per MIV cell: cell 1, 128; cell 2, 126; cell 3, 127.

† Number of observations per MIV cell: cell 1, 100; cell 2, 95; cell 3, 96.

‡ Number of observations per MIV cell: cell 1, 146; cell 2, 145; cell 3, 135.

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