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### Authors

Cohen, Isabelle  
Abubakar, Maryam  
Perlman, Daniel

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# Pathways to Choice: A Bundled Intervention against Child Marriage

Isabelle Cohen      Maryam Abubakar      Daniel Perlman \*

## Abstract

We undertake a randomized evaluation of “Pathways to Choice”, which provides mentored girls’ clubs, life skills, and vocational training to empower adolescent girls to delay marriage and pursue education in Northern Nigeria. Two years post-intervention, adolescent girls in treated communities are 65 percentage points less likely to be married, estimates an order of magnitude larger than comparable interventions. An important channel is the program’s effects on educational uptake, which increases by 69 percentage points among the treated. However, the effects on education are themselves insufficient to fully explain the effects on child marriage, suggesting the bundled nature of the program is essential to its success. We argue that the whole community focus of the program reduces the likelihood of social backlash, allowing Pathways to produce large effects on entrenched, normative behavior.

JEL Codes: I25, J12, J13, J16, J24, O15

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\*Cohen: Evans School of Public Policy & Governance, 4105 George Washington Lane NE, Seattle, WA 98105; imcohen@uw.edu. Abubakar: Department of Chemical Engineering, Ahmadu Bello University. Perlman: OASIS Initiative, University of California, Berkeley. We thank all those who provided invaluable feedback and guidance on this paper, including seminar audiences at the Northwest Development Workshop, the Pacific Conference for Development Economics, and the Center for Studies of African Economies Annual Conference. We also thank Erica Field, Alan Griffith, Jason Kerwin, Emily Nix, Rebecca Thornton, Emma Riley, Alessandra Voena, and many others, for their helpful comments and suggestions. We gratefully acknowledge the work of the Centre for Girls Education in Abuja, Nigeria. This paper has previously circulated under the title Pathways to Choice: Delaying Marriage and Increasing Education via Safe Spaces. This project was approved by the Ahmadu Bello University Health Research Ethics Committee, Number ABUTHZ/HREC/W29/2021 and is registered with the AEA RCT Registry as AEARCTR-0010407. The views presented are our own, and do not necessarily represent the views of any other organization. All errors are our own.

Empowerment is often defined as the ability to make strategic life choices, choices critical for people to live the lives they want (Kabeer, 1999). In writing on this subject, Kabeer (1999) defines two pre-cursors for the ability to exercise choice: resources, including the material, the human and the social, acquired through the various institutional domains of society; and agency, which is the ability to define one’s goals and act upon them. Jointly, these are referred to by Sen (1985) as capabilities, or the potential that people have for living the lives they want. Marriage at a young age represents a significant, pervasive, and substantial impediment to aspirations of global gender empowerment, with more than 650 million women alive today married as children (UNHR, 2023).

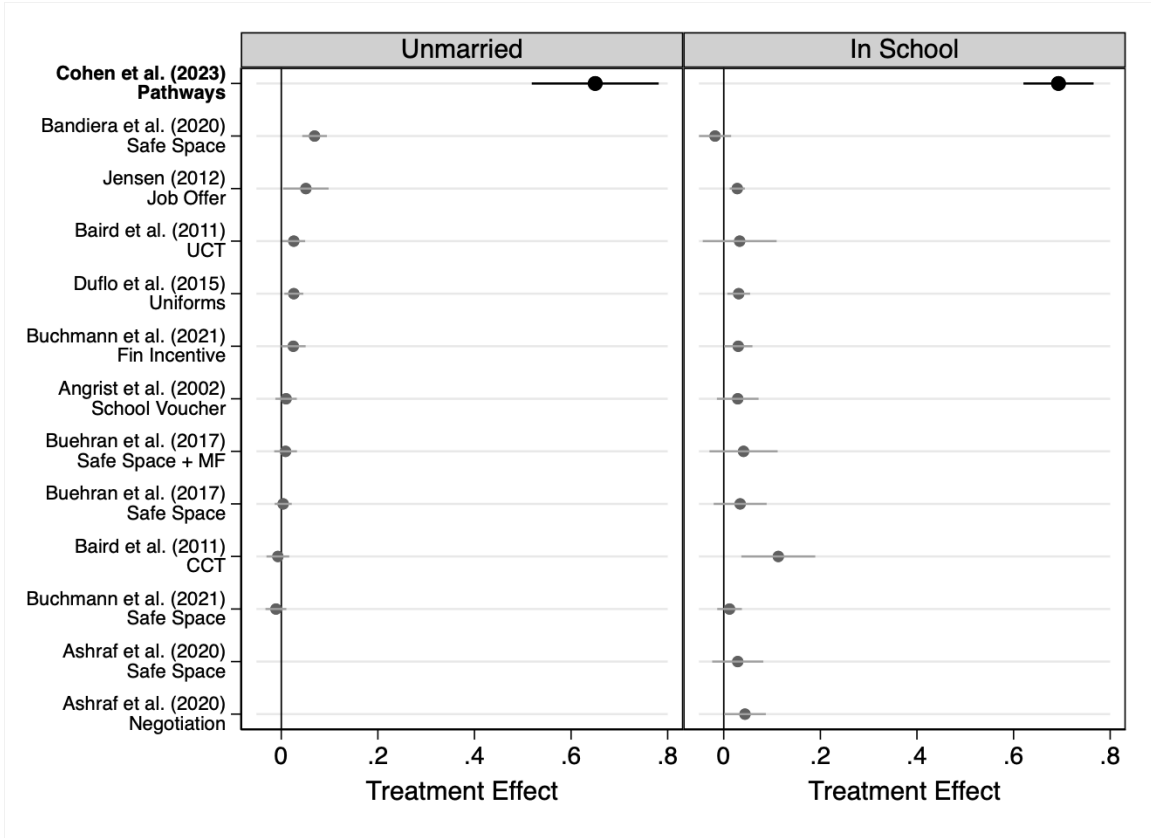
Northern Nigeria is a context in which adolescent girls often lack both resources and agency. As a region, northern Nigeria has some of the highest rates of child marriage in the world. Estimates suggest that 48% of girls in northern Nigeria are married before the age of 15 (“child marriage”) and close to 78% before the age of 18 (“adolescent marriage”) (Save the Children, 2021). Consistent evidence shows that delaying marriage increases female educational attainment and improves health, including several studies that use age of menarche as an instrument for marriage timing (Asadullah and Wahhaj, 2018; Field and Ambrus, 2008; Hicks and Hicks, 2019). Parsons et al. (2015) has a thorough discussion of documented negative effects of child marriage on many aspects of the futures of adolescent girls, including agency, education, labor force participation, violence and health. Evidence on intergenerational transmission also shows that delayed marriage leads to improvements in the health and education of (future) children (Chari et al., 2017; Sekhri and Debnath, 2014).

The realization of potential in outcomes can be thought of as the achievements of empowerment. Many interventions aiming to end child marriage involve causal pathways that lead either only through resources or only through agency. For example, safe space programs and other traditional empowerment programs often focus only on agency, without significant resource provision. Even programs which focus on both are often hesitant to provide significant investments in resources, given a cost-constrained environment. This paper studies the “Pathways to Choice” program in northern Nigeria, a bundled, “big-push” intervention developed and implemented by the Center for Girls Education (CGE). Pathways enrolls out-of-school adolescent girls aged eleven to seventeen in mentored girls’ clubs (“safe spaces”), with a set two-year curriculum. In the first year, girls receive social support, remedial education, and vocational training. In the second year, girls choose between school and further vocational training, and receive in-kind financial support under either path, along with continuous mentored social support.

Our evaluation tests the effects of Pathways on adolescent girls using a cluster randomized control trial in eighteen paired communities in Borno, Kaduna and Kano states, with a total sample of 1,171 girls. We find significant and meaningfully large effects of the intervention: Pathways leads to a 480% increase in the likelihood that girls remain unmarried two years after the intervention starts, from 14% in the control group to 80% in the treatment group, and a 680% increase in the odds of currently being enrolled in school. Pathways also significantly increases measures of gender equitable beliefs, and indices of self-advocacy and self-perception. We also provide limited evidence of spillovers, showing that Pathways increases the likelihood that an adolescent girl’s younger sister is also enrolled in school.

Relative to the existing literature, these effects are even larger than they may initially appear. Many interventions which have failed to delay marriage for adolescent girls in various contexts, and many of those that have succeeded have had effects considerably smaller than Pathways. Broad policy efforts, such as age-of-marriage laws, have historically been unsuccessful, though these results likely have much to do with a lack of enforcement and monitoring of such laws (Collin and Talbot, 2017). Randomized evaluations have looked at a variety of policies, including cash transfers (Baird et al., 2011; Buchmann et al., 2021), the provision of free uniforms (Duflo et al., 2015), negotiation training (Ashraf et al., 2020) and safe space programs in various contexts (Ashraf et al., 2020;

Bandiera et al., 2020; Buchmann et al., 2021; Buehren et al., 2017).



Pathways Effects Relative to Other Evaluations

To illustrate this, we compare the point estimate magnitude of the Pathways program to 8 other papers, representing 12 interventions, evaluated relatively recent using randomized evaluation methods. For each, outcome data two to three years post-intervention is available for either the likelihood of remaining unmarried, the likelihood of being in school, or both. The full list of papers and interventions is available in Appendix Table A.1.

Though many of these interventions were successful in affecting one or both outcomes, Pathways consistently outperforms them all. Jensen (2012) studied the provision of business process outsourcing jobs to young women in India, and found that job offers increased the likelihood of being in school by 2.8 percentage points, and decreased the likelihood of ever having married by 5.1 percentage points. In Colombia, Angrist et al. (2003) found that vouchers to attend private school did not affect the likelihood of remaining in school or unmarried, though they did lead to meaningful increases in years of schooling completed. Negotiation training in Zambia increased the likelihood that young women remained in school by 4.4 percentage points (Ashraf et al., 2020). Unconditional cash transfers in Malawi led to a 2.6 percentage point increase in the likelihood of adolescent girls remaining unmarried after two years, while conditional cash transfers increased the likelihood of girls remaining in school by 1.1 percentage points (Baird et al., 2011).

Many of these recent evaluations have focused on safe spaces. At their core, these programs create places where young women can engage without boys or men (Megevand and Marchesini, 2020).

Many such programs include life skills and brief livelihoods training, delivered through adolescent development clubs by adult mentors or peer sessions; some target in-school girls, and others target out-of-school girls. The Empowerment and Livelihoods for Adolescents (ELA) program in Uganda is one example, and demonstrated significant delays in early marriage (about 7 percentage points, corresponding to a 53% decrease), along with increases in self-employment and reductions in teen pregnancy (Bandiera et al., 2020). An evaluation of the same program in Sierra Leone, despite being interrupted by the 2014-15 Ebola epidemic, found that five years after girls’ clubs were initially formed, girls were much less likely to have experienced an adolescent pregnancy, and much more likely to have re-enrolled in school (Bandiera et al., 2020).

However, these programs have not always proven effective. Buchmann et al. (2021) evaluate an adolescent girls’ empowerment program in Bangladesh which establishes safe spaces for girls and provides life skills via peer mentoring, which was cross-randomized with in-kind financial incentives to delay marriage. The authors find that the empowerment program on its own had no significant effect on child marriage, but was effective in increasing schooling; on the other hand, the conditional incentive was effective in reducing child marriage by 5 pp (19%) over 4.5 years. An adaptation of the ELA program described above in Tanzania, similarly, had no effect on marriage, fertility or educational outcomes (Buehren et al., 2017), and the safe spaces program evaluated by Ashraf et al. (2020) did not meaningfully affect educational outcomes.

Though Pathways utilizes safe spaces, there are a number of key differences between it and other interventions that help explain its success. Safe spaces programs typically focus on agency, helping girls identify their goals, though some may also improve social resources in the form of support from other adolescents. Pathways combines this more conventional mentored girls’ club style intervention with aggressive educational and vocational support, and does so with whole cohorts of out-of-school adolescents, which in this context comprise the vast majority of unmarried girls, and – due to a high likelihood of endogamous marriage – are likely to be each other’s primary “competition” in the marriage market. Our results suggest that interventions which combine contextually-appropriate resources with agency may have significantly greater impacts than interventions which focus on only one or the other, attributable to strategic complementarities between components. Though our evidence remains suggestive, we argue that the community focus of the intervention also contributes to its ability to shift normative behavior.

## 1 Pathways in Context

The Pathways program is a bundled intervention that takes place over a two year period. The first year of the program focuses on accelerated remedial education, including literacy, numeracy, life skills and financial literacy. Clubs also deliberately introduce girls to women working as traders, teachers, health extension workers and midwives, socially acceptable trades in northern Nigeria. Once completing this intensive training, girls are offered the option to return to government schooling with coverage for direct and indirect school fees, or to enter a yearlong vocational training program that culminates in an apprenticeship in a community-based shop. The trades in the community-based shops are tailored to local demand, and can include phone and electronics repair, groundnut oil processing, shoe making, animal husbandry or tailoring. After the second year, CGE-owned shops remain in these villages. Through apprenticeships and after the program officially ends, all participants can work in the community-based shops.

Throughout both years of the program, girls are supported via regular meetings with a safe spaces mentor, who tend to be young woman from similar backgrounds and receive consistent support

supervision. The safe spaces include an average of eighteen adolescent girls, and meet for two hours per week in private rooms in the homes of respected community leaders. In the confidential group setting, girls can discuss reproductive health concerns and develop social bonds with girls of similar ages in their communities (Perlman et al., 2016).

Pathways, and other programs by CGE, are introduced into communities through a careful process of engagement. Teams meet first with traditional leaders, and then groups of mothers, fathers, teachers, informal leaders, and other key stakeholders, discussing girls' education and social and economic barriers to access; local religious leaders are invited to a one-day workshop to examine support in the Qur'an and Hadith for girls' education. The findings from these discussions and meetings are shared with the broader community before the program ever begins working with girls (Perlman et al., 2016). In most communities, all eligible girls enroll in the program.

In northern Nigeria, the decisions of whether to attend school and when to marry are made jointly between adolescent girls and older familial authority figures, most likely parents. The relative weight on the two sets of decision-makers is likely to vary at the family level (Perlman et al., 2017). Cultural context suggests that the two decisions are also intertwined; when school is believed not to be of value, the parents are generally more likely to encourage the girl to marry. Parental beliefs about the value of schooling can be described by two parameters: beliefs about the quality of schooling available to them in general, and beliefs about the benefits of schooling for female children in particular. In combination, these parameters define the parents' expected value of available schooling for their female children.

Basic education systems in these regions of northern Nigeria are lacking. A learning assessment in Bauchi and Sokoto states in 2011 found that by the end of third grade, only 6% of students were able to read a simple sentence, and furthermore that girls' reading scores were even lower than those of boys (RTI International, 2011). Data from the 2018 Nigeria DHS show that only 41% of women under the age of 35 in northwestern and northeastern Nigeria have ever attended school (National Population Commission - NPC/Nigeria and ICF, 2019). 67% of women in the same sample are unable to read, and 50% of those who report having attended school are unable to read a whole sentence (National Population Commission - NPC/Nigeria and ICF, 2019). Given the low quality of public education, parents may be justified in strategically deciding that school is unlikely to bring about significant returns for their children, particularly female children. Though its bundled approach, the Pathways program increases not only aspirations, but also both the quality of schooling available to girls (through initial literacy and numeracy education and follow-up support) as well as the perceived returns to schooling (via employment opportunities in Pathways shops).

The villages in Pathways are also contexts where endogamous marriage is common. 65% of ever-married women report having always lived in their current city, town or village; only 17% of women had moved within two years of their first cohabitation, suggesting exogamy is considerably less common than endogamy (National Population Commission - NPC/Nigeria and ICF, 2019). This feature of marriage markets implies that girls of similar ages in the same village represent "competition" for a given girl. High community participation likely ameliorates potential marriage market penalties for participating in Pathways, if girls are compared to peers who are also participating. Additionally, because girls remain in the locations in which they access Pathways, the community shops are likely to remain available as an option for girls post-marriage; qualitative work suggests that for many women, work in their village may be more feasible and likelier to be permitted than work elsewhere. Correspondingly, vocational training and employment opportunities provided by Pathways also create tangible opportunities for financial returns to girls' education.

## 2 Evaluation Design and Econometric Strategy

The evaluation focuses on 1,171 girls in eighteen communities in Borno, Kaduna and Kano states in northern Nigeria. Communities were paired by CGE on the basis of size and the number of out-of-school girls, vulnerability, accessibility, and rates of child marriage, then randomized within pairs between treatment and control. A baseline survey of all eligible girls aged eleven to seventeen in all selected communities was completed prior to the beginning of the Pathways intervention in 2018, with an endline survey conducted in the same communities two years later in 2020. The Pathways to Choice program was implemented by three organizations – the Centre for Girls’ Education (CGE) in Kaduna, Isa Wali Empowerment Initiative (IWEI) in Kano, and the Hallmark Initiative in Borno – with CGE designing and supervising the program, serving as the learning and administrative hub for the project, and overseeing the evaluation.

We estimate:

$$Y_{ij1} = \alpha + \beta T_{ij} + \delta Y_{ij0} + X_{ij0} + X_{ij0} \cdot T_{ij} + \nu_j + \varepsilon_{ij} \quad (1)$$

where  $Y_{ij1}$  is an outcome of interest for girl  $i$  in pair  $j$ , measured at the endline (represented by time period 1). To maximize power, we control for a measure of the outcome  $Y$  at baseline,  $Y_{ij0}$  (McKenzie, 2012).  $T_{ij}$  is a community-level treatment dummy variable, indicating whether a girl’s community was assigned to treatment or control.  $\nu_j$  represents pair-fixed effects, which in this context double as strata-fixed effects (Bruhn and McKenzie, 2009). Additionally, we control for a set of demeaned covariates measured for each girl at baseline,  $X_{ij0}$ , both independently and interacted with treatment dummies to improve flexibility. Standard errors are clustered at the village level (Abadie et al., 2023). In our tables, we report wild cluster bootstrap  $p$ -values to account for the fact that we have only 18 clusters in the sample, as otherwise cluster-robust standard errors might be too small (Cameron et al., 2008, Roodman et al., 2019). For our main specification, we also show robustness to randomization inference  $p$ -values, randomly reassigning villages within stratification pairs and then re-estimating treatment effects for simulated assignments using equation (1) to construct a distribution (Athey and Imbens, 2017).

We account for multiple hypothesis testing in two ways. First, we report sharpened  $q$ -values in all tables to account for multiple hypothesis testing by controlling for the false discovery rate (Anderson, 2008, Benjamini et al., 2006). Second, for most outcome families, related variables are grouped into index variables, following Anderson (2008). Details on the construction of indices used in the analysis are available in Appendix B. Overall, we estimate effects on outcomes including marital status, school attendance, educational intensity, financial behavior and likelihood of having a younger sister in school and attitudes including marriage-related self-advocacy, school-related self-advocacy, self-perception, social support and gender equitable beliefs.

The two groups were reasonably balanced at baseline. Out of the 22 baseline variables tested for balance in Table I, 4 are statistically significant at the 0.05 level, and 1 at the 0.10 level. Given that the study contains nine pairs and eighteen villages, this level of imbalance is not unexpected. Though most of the differences are small in magnitude, there are some relatively large initial differences in self-perception, social support and an index measure of socio-economic status.<sup>1</sup> On the primary outcomes of interest – marital status and school attendance – the groups are highly balanced, with large  $p$ -values and similar means.

These baseline covariates also present a helpful description of the girls in the Pathways program.

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<sup>1</sup>All variables unbalanced at baseline are controlled for in the primary specification as part of  $X_{ij0}$ , both independently and interacted with treatment to increase flexibility; all results are highly robust to the inclusion and exclusion of covariates.



At baseline, the average girl in the sample was 13.5 years old, though self-reported ages ranged from eleven to seventeen years old. Approximately 90% of the girls in both treatment and control villages were unmarried, and only 2.5% were currently enrolled in school. The average girl reported that she wished to marry around age 18, and over 30% of the girls expressed a desire to continue their education. Approximately 48% of girls reported that they would be able to talk to a family decision-maker about the age at which they married; only 11% of girls had done so recently. Similarly, 58% of girls reported that they felt they could have spoken with a family decision-maker about whether or not to attend school, though only 20% reported actually doing so. The table also shows the lack of differential attrition between the treatment and control villages at endline, with a consistent 91% rate of re-surveying.

There are missing values for some variables at endline, leading to differing numbers of observations in the tables below. Table A.2 assess whether there is any correlation between whether a variable is missing and treatment status. In all cases, we fail to reject the null hypothesis of no difference.

### 3 Results

The core results of the intervention are in Table II. Relative to the control group, Pathways produces a 480% increase in the likelihood of remaining unmarried, an increase of 65 percentage points for the average Pathways participant. Within the control group, the likelihood of being married increases from 9% at baseline to 86% at endline over the two years between the surveys. Among the treatment group, the likelihood of being married increases from 9% at baseline to only about 21%. Pathways girls were also 680% as likely girls in the control group to report attending school at the endline, a 69 percentage point increase relative to the control group and an increase of about 76 percentage points relative to baseline school enrollment levels of 3%. These results – which are highly robust to changes in specification, wild cluster bootstrap  $p$ -values, sharpened  $q$ -values, and randomization inference  $p$ -values – overwhelmingly demonstrate Pathways’ effectiveness in preventing child marriage and increasing levels of education for girls.<sup>2</sup>

An index of financial behavior measuring earnings, planning and savings behavior suggests that Pathways may improve financial habits and gender equitable beliefs, with quantitatively large effects in standard deviation terms. Both results are robust to corrections for inference, but become (weakly) insignificant when  $p$ -values are corrected for the small number of clusters.

The strength and magnitude of these result are unlikely to be consistent with Pathways working only through participants. Changes in attitudes are substantial, including beliefs about self-advocacy, and self-perception. However, changes in beliefs alone are unlikely to translate to changes in outcomes without parental buy-in. The joint nature of the decision between adolescent girls and their parents (or other figures holding parental authority) mean that such results would be unlikely without changes in parental attitudes, such as regarding the return to schooling. Equivalently, it is likely that by changing the majority of the supply of girls to the marriage market (given the high prevalence of endogamous marriages), the Pathways program is perceived as avoiding potential “penalties” for non-normative behavior.

In short, the Pathways program is fundamentally bundled, including educational support, social and self-advocacy support, and a whole community focus. This bundling likely creates strategic

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<sup>2</sup>As can be seen in Table A.3, results are nearly identical when excluding all covariates other than pair fixed effects, and when including all baseline covariates from Table I in the specification. Though not reported here, the results are robust to the exclusion of pair fixed effects. Wild cluster bootstrap  $p$ -values are reported in Appendix Table A.4 (Cameron et al., 2008; Roodman et al., 2019).

complementarities essential to the program’s success. In a context where early marriage is not just common, but overwhelming the norm for adolescent girls, it is likely that a lighter touch intervention would be unlikely to succeed (at least over a relatively short time horizon).

Despite the obvious challenges, we attempt to unpack channels of effect in three steps:

1. First, we dig deeper into the results on education, including richer results on schooling intensity. By comparing across baseline socio-economic status and conducting mediation analysis, we provide suggestive evidence that a girls’ own education status is insufficient to fully explain the effects of the program on marriage delay.
2. Second, we examine heterogeneity by cohort age and sibling presence to provide evidence on the importance of the whole community focus of Pathways.
3. Third, we present evidence on other outcomes, including self-advocacy, reinforcing the bundled nature of both the program and its mechanisms.

### 3.1 Schooling as Outcome and Pathway

*“My first daughter graduated from primary school and can’t read a word. I won’t send my second daughter.”*

- Mother of adolescent girl in qualitative interview (Perlman et al., 2017)

In rural northern Nigeria, schooling is often not viable for a typical girl in the absence of support as directed and intensive as the Pathways program. At baseline, only 30% of girls had ever attended any kind of formal school and between 2% and 3% of girls were currently enrolled. Qualitative work by Perlman et al. (2017) suggests that demand exists among parents for the education of female children, but the supply of (quality) schooling is inadequate. With the targeted, unstigmatized support provided within Pathways, it is not infeasible that girls make more progress during the nine months of the program than they would have during any prior exposure to formal education; for those who never attended school, which is the majority of the sample, Pathways provides an even greater relative improvement in instructional quality.

Pathways leads to meaningful increases in schooling on the extensive and intensive margins of schooling, as documented in Table III, all of which are robust to different methods of estimating statistical significance. Relative to girls in the control group, Pathways participants spend more time on school and are more likely to aspire to continue their education. In addition, we find evidence of spillovers from Pathways participants to younger siblings, and younger sisters in particular. Pathways doubles the likelihood that an adolescent respondent reports that she has a younger sister who is currently attending school, with a 28.5 percentage point increase. We cannot differentiate between changes in parental beliefs and older girls acting as academic resources for younger siblings; nonetheless, the results suggest that our focus on participants may understate the community-level effects of the intervention.

Figure VII shows that Pathways disrupts the link between socio-economic status at baseline and education. For girls in the control group at endline and their younger sisters, socio-economic status is highly correlated with likelihood of school attendance; about 30% of control group girls in the fifth quantile of estimated socio-economic status currently attend school, as opposed to barely 4% of girls in the first quantile. This correlation also holds for the likelihood that any younger sister of the surveyed girl is in school; the likelihood of that a surveyed girl has at least one younger

sister attending school is 12% in the first quantile, as opposed to 54% in the fifth quantile. Since parental socioeconomic status here is based at least in part on parental education and literacy, these results are consistent with parents with higher socioeconomic status being better able to provide supplementary support to make education worthwhile, though differing preferences or beliefs about the value of education for girls in particular cannot be ruled out.

Among participants, Pathways universally increases the likelihood of attending school to between 70% and 80%, regardless of socioeconomic status. In fact, among the treatment group, there is very little relationship between socioeconomic status and school attendance, suggesting Pathways levels the playing field between girls of differing socioeconomic status, at least with regard to school attendance. While some correlation persists among the younger sisters of Pathways participants' school status and household socioeconomic status, for all groups but the lowest quartile the likelihood that at least one younger sister attends school increases to 50% or above, higher than attendance rates in the highest quantile among treatment communities.

*“If a girl is getting a quality education, her mind will be occupied with school and she won’t have time to spend with boys.”*

- Mother of adolescent girl in qualitative interview (Perlman et al., 2017)

A natural question is whether, given that schooling is viewed locally as an alternative to early marriage, Pathways’ effectiveness in delaying marriage is attributable to increasing the uptake of schooling. It is possible that intensive remedial education alone would be sufficient to produce the delays in marriage shown here. Though evidence shows that making primary and secondary schooling decreases child marriage rates (e.g., Bhuwania et al., 2023), the magnitudes are generally much smaller than the effects of Pathways. We use the sequential  $g$ -estimator of Acharya et al. (2016) to estimate what proportion of the treatment effect on child marriage is explained by changes in educational status, alongside other mediators.

First, we estimate the effects of the mediators on the outcome variable, and create a “demediated” outcome by removing the effects of those mediators from the outcome. We then regress the demediated outcome on the treatment indicator, which should give the controlled direct effect of treatment on the outcome, or the effect net of changes in the mediator. Unless we have identified all potential mediators, it is unlikely that our estimate of the effect of the treatment on remaining unmarried is the true, causal “direct” effect; however, it should allow us to assess the extent to which accounting for education as a potential pathway explains the effects of Pathways on child marriage.

The results of this exercise are presented in Table IV. We present two specifications: in the first, potential mediators enter the model linearly; in the second, they are interacted with treatment. The estimated coefficient is from the regression of the mediated outcome on the treatment indicator. As well, we present results where the only mediator is education, and results where gender equitable beliefs, self-perception and social support are also accounted for. The bottom row of the table compares the controlled direct estimation to the original estimation in Table II. The results suggest that education explains approximately 30% of the magnitude of the direct effect, when interacted; the estimates are nearly unchanged when accounting for other potential mediators. These results suggest that while school attendance is central to the effects of Pathways, it is not sufficient to fully explain the magnitude of the effects on child marriage.

## 3.2 Whole Community Engagement

*“Some people saw me as someone who didn’t know what he was doing. They thought that I should marry my daughter off rather than keeping her in school. They said the program is not religiously acceptable. But our religion isn’t like that. Islam does not disallow a child from getting an education. ... Now even the Imam has two of his daughters in the program.”*

- Father of adolescent girl in qualitative interview (Perlman et al., 2016)

Pathways was developed through local ethnographic and participatory research, and is deliberately and intentionally designed to make the curriculum socially acceptable. The program is initially introduced into the community through village and religious leaders, before being shared more broadly. The curriculum is slow and deliberate in introducing the idea of education and self-advocacy for adolescent girls, and does so in ways deliberately grounded in the Qur’an. Pathways works with nearly 100% of eligible girls in its program communities, ensuring that participation is normalized within the community.

Table V tests several hypotheses in support of the whole community nature of the program. Consistent with the importance of this channel, aspirations change as a result of the intervention; for unmarried girls, the desired age of marriage increases significantly. Note that this result is likely also a function of the age of girls increasing; however, despite control girls also growing older, the control mean at endline is 18, and almost identical to what it was at baseline two years earlier. This suggests that the four and a half year increase in desired marriage age among intervention girls results from Pathways changing aspirations, rather than a natural change among older girls.<sup>3</sup>

As well, the Pathways program leads to an increase in an index of social support. That girls in Pathways communities report feeling more connected to family and female friends is likely a direct result of the program deliberately fostering such ties, but is also consistent with broader community engagement. If nothing else, these results suggest that closer bonds with other girls in the same program groups do not come at the cost of worse relationships with family or non-participants.

The community nature of the Pathways program gives rise to clear hypotheses about how potential differences in community make-up may affect the effectiveness of the program. For example, if Pathways works through making marrying later socially acceptable for program girls, it should be relatively less effective in areas which happen to have an older cohort of girls. Pressure to marry increases as girls grow older, and a girl with an older cohort of unmarried girls may feel more pressure herself to marry as she watches others do so. Similarly, the most direct, natural comparison for a girl may be her sister; since polygamy is common in the locations where Pathways takes place, many girls in treatment and control villages have a number of sisters in the appropriate age range for the intervention. Conditional on the number of siblings, an increase in the number of treated siblings (measured as girls in the same village with the same father) should increase the effectiveness of the program, particularly on marital outcomes.

We test these hypotheses in Table VI in two different specifications. First, we interact the treatment dummy with a variable capturing the average age of all girls other than the participant herself in her community, demeaned. Conditional on the girl’s own age, estimation based on variation in the age make-up of other unmarried, out-of-school girls in the same community should not be sub-

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<sup>3</sup>Note that many observations are missing for the variable containing desired age of marriage. Table A.2 shows that these patterns of missing responses are not differential by treatment status. The missing data comes chiefly from implementation issues, which also differed between states; a breakdown of analysis by state is available in Table A.5. In Kano and Borno, the question was asked of everyone (not only unmarried girls), and though both states show positive coefficients, the results are primarily driven by Borno. The question was not asked in Kaduna.

ject to exclusion bias (Caeyers and Fafchamps, 2020). We find that particularly for the marriage outcomes, a year increase in the average age of her cohort leads to a significant attenuation of the Pathways effect; a one-year increase in the average age of one’s groupmates, conditional on one’s own age, nearly halves the estimated treatment effect. This result is not robust to estimation using wild cluster bootstrap  $p$ -values, though it remains relatively close to statistical significant.

Second, we interact the treatment dummy with a variable that captures the number of girls in the village with the same father’s name, demeaned. To account for family size, we condition on the number of sisters the participant reports at baseline, both linearly and interacted with treatment. Having an additional sibling eligible for the program increases the effects on child marriage by roughly 10%, or a seven percentage point increase, and the interaction term is robust to the use of wild cluster bootstrap  $p$ -values.

Overall, these findings lend strong, credible support for the hypothesis that community engagement and the shifting of norms in Pathways communities are essential to the success of the program in delaying early marriage.

### 3.3 Self-Advocacy

*“The girls speak up for themselves. They might not get what they want, but they express themselves well, and people appreciate that.”*

- Mother of adolescent girl in qualitative interview (Perlman et al., 2016)

The bundled nature of the program makes it difficult to determine the precise mix of mechanisms leading to the substantial effects on child marriage. Although in the context of northern Nigeria, parents or other adults are likely to be the primary decision-makers around marriage timing, it is plausible to think that girls may also have the ability to advocate for themselves on marriage timing or partner choice; Ashraf et al. (2020) suggests that, at least in the context of schooling, negotiation skills can have a meaningful effect. Relatedly, an explicit goal of Pathways is to increase self-advocacy among participants, and sessions include coaching on how to approach conversations around marriage and schooling.

Table VII looks more directly at self-advocacy as an outcome. We assess the effects on Pathways on indices of marriage self-advocacy and schooling self-advocacy, which aggregate different measures of discussions around marriage or continuing schooling, respectively, including whether the girl engages in direct conversation or asks an adult of standing to intervene on her behalf, or expresses a willingness to do either. For both marriage and schooling, questions were focused on the subset of girls to whom they were relevant, though some married girls answered marriage self-advocacy questions, and girls both in and out of school answered schooling self-advocacy questions. On both indices, Pathways participants scored as meaningfully more engaged in self-advocacy; participants were likelier to engage in actively seeking out their goals by .77 standard deviations (marriage) or .50 standard deviations (schooling self-advocacy). These results are consistent with meaningful improvement in self-advocacy among Pathways participants.<sup>4</sup>

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<sup>4</sup>Note that many observations are missing for the indices on marriage and schooling self-advocacy. Table A.2 shows that these patterns of missing values are not differential by treatment status. The missing data comes chiefly from implementation issues, which also differed between states; a breakdown of analysis by state is available in Table A.5. Of importance is that in Kano and Borno, the questions were asked to all girls (sometimes in a retrospective or hypothetical way) and in Kaduna, they were asked only to unmarried girls (for marriage self-advocacy) and girls not in school or who had dropped out (for school self-advocacy). The results in Kaduna are therefore likely to be driven by a mix of attitudinal and self-advocacy changes and selection effects. They look similar for marriage self-

Pathways participants also scored higher on a self-perception index, which focuses on a respondent’s feeling that she is valued, trusted, and of importance. Pathways led to a .56 standard deviation increase in an aggregate self-perception index, consistent with the ability to engage in more meaningful and effective seeking out of one’s goals.

## 4 Cost-Benefit Analysis

The Pathways to Choice program is relatively expensive compared to many alternative programs, with a high upfront cost of investment per girl. It is helpful to compare between the intensive, expensive Pathways program, which provides two years of direct support to adolescent girls in remedial education and vocational training, bundled with uniforms, school fees, and related support, and low-cost programs which provide school uniforms (Duflo et al., 2015) or conditional financial incentives (Buchmann et al., 2021). While these programs are often effective in their own right, this evaluation of the Pathways program has demonstrated effects on marital and educational status of a significantly larger magnitude. It is therefore worth exploring the cost-benefit ratio and cost-effectiveness of Pathways.

To answer this question, we follow Field et al. (2016) in constructing measures of cost-effectiveness and cost-benefit ratios. We use two traditional benefit-cost measures to assess the value of the program to society as a whole: the net present value of the program per \$1,000 spent and the benefit-cost ratio. In both cases, the total cost of the program includes both the spending by the implementor, and the “cost” to the participants in terms of foregone experience in the labor market, using a social discount rate of 5%. Specific details on the construction of returns to education and experience and the details of benefit and cost construction, as well as the simpler cost-effectiveness measures discussed below, are available in Appendix C. We calculate a net present value of \$1,627 per \$1,000 invested and benefit-cost ratio of 2.41. Though not the most cost-effective program among those analyzed by Field et al. (2016), Pathways is distinctly competitive with other, lighter-touch interventions despite its “big push” methods.<sup>5</sup>

We also calculate simpler measures of cost-effectiveness: years unmarried per \$1,000 spent, and years of schooling per \$1,000 spent. For both methods, we look both at total spending (amount invested by implementers and cost of foregone experience to adolescent girls) and total investment (amount invested by implementors only). In this case, we calculate the total by multiplying the point estimate from the intervention by the number of intervention participants to calculate the number of additional years unmarried and the number of additional years of schooling, then divide by the appropriate measure of cost. We estimate the program results as .41 years unmarried per \$1,000 spent (inclusive of implementor and participant costs) and .44 years of schooling per \$1,000 spent (inclusive of implementor and participant costs). On these measures, Pathways is as cost-effective as almost any program considered by Field et al. (2016). In terms of returns to implementor costs, the Pathways program results in 1.88 additional years unmarried per \$1,000 invested (by implementors

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advocacy; for schooling self-advocacy, the differences are statistically insignificant. Since the share of girls in school increases dramatically under Pathways, this is most consistent with negative selection; girls who drop out in Pathways communities are likely to be less interested in self-advocacy or less able to self-advocacy than girls who drop out in control communities. The null result with a negative sign may suggest some positive effects depending on the extent of negative selection, but would also be consistent with no effects for this subsample.

<sup>5</sup>Direct comparisons between our analysis and Field et al. (2016) are complicated because they present their programs based on the educational returns to delayed marriage in Bangladesh, and we use the educational returns to delayed marriage in Nigeria. Nonetheless, in practice donors may be comparing not only between programs, but also between countries when making decisions about investment. As such, we think it reasonable to look directly at our numbers relative to theirs.

only) and 2.01 additional years of schooling per \$1000 invested (by implementors only).<sup>6</sup>

In other words, considering the relatively high costs of Pathways to implementers (particularly relative to other lighter toucher interventions), it is striking that the program appears to be relatively cost-effective, even without accounting for spillovers onto non-participants.

## 5 Conclusion

The Pathways to Choice program leads to enormous reductions in early marriage in northern Nigeria. Out-of-school girls are at some of the highest risk for early marriage; over two years, girls with an average age of 13.5 in the control group have an 87% likelihood of being married. Pathways participants, on the other hand, see a dramatic reduction in marriage rates, with only 20% married by the end of the study. Intertwined with this result is their stark increase in the likelihood of attending school; only 10% of control group girls are attending school by the end of the two year study period, but this rate increase to nearly 80% among Pathways participants.

Despite operating in an environment in which child marriage is widespread, the Pathways program is able to greatly reduce the likelihood of early marriage. Although increases in school attendance are a crucial driver of this result, mediation analysis suggests that they are insufficient to fully explain it. Evidence on cohort effects suggest that the whole community nature of Pathways is likely an important driver of results. Evidence from the evaluation also shows meaningful increases in self-advocacy among participants. Complex systems require complex interventions; when it comes to changing norms around early marriage, feasible alternatives, community support and self-advocacy all play crucial roles.

The results from the evaluation Pathways are an important contribution to the existing literature on empowerment programs. Our findings suggest that the whole may be more than the sum of the parts. Likely complementarities between program components mean that a big push intervention succeeds in magnitudes that are impossible when making small, incremental changes. Though programs like Pathways are more expensive to administer, cost-benefit and cost-effectiveness analysis suggest that the magnitude of the effect means they may nonetheless be competitive with lighter touch interventions, with real potential to transform the lives of participants.

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<sup>6</sup>Note that these measures are the most directly comparable between contexts, as they do not require making any assumptions about returns to schooling or experience

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Table I: Balance Table

Variable	Obs	Control	Treated	p-value
Girl is Unmarried (d)	1162	.909	.906	0.977
Girls Attends School (d)	1166	.019	.033	0.336
Younger Sister in School (d)	893	.29	.383	0.458
Educational Intensity Index	1179	0	.449	0.112
Marriage Self-Advocacy Index	1041	0	-.014	0.946
School Self-Advocacy Index	847	0	.124	0.419
Financial Behavior Index	1090	0	.165	0.298
Self Perception Index	1172	0	.685	0.008
Social Support Index	1174	0	.565	0.012
Female Decision-Making Index	1177	0	-.376	0.172
Hours Spent on School	1114	.06	.281	0.040
Worked Last Week (d)	1168	.409	.53	0.163
Supports Daughter Working Index	1173	0	.137	0.472
Household Asset Index	1179	0	.497	0.017
Desired Marriage Age	495	18.4	18.5	0.917
Weekly Pay (USD)	965	5.24	2.23	0.196
Worked Last Year (d)	1168	.455	.589	0.121
Age in Years	1041	13.4	13.3	0.570
Avg Age of Others	1181	13.4	13.3	0.571
Aspires to Continue Ed (d)	813	.334	.516	0.186
Supports Wife Decision-Making	1174	.436	.293	0.175
Socioeconomic Index	1181	0	.544	0.033
Not Found at Endline (d)	1181	.086	.093	0.904

Note: This table presents baseline balance for the Pathways intervention. Each row represents a regression of the variable indicated at baseline on a treatment indicator. In this analysis: i) p-values are calculated based on two-sided tests with robust standard errors clustered at the community level; and ii) indices, where indicated, are constructed following Anderson (2008) and expressed in standard deviation units, demeaned relative to the control group.

Table II: Effects of Pathways

	(1) Unmarried (d)	(2) In School (d)	(3) Financial Behavior Index	(4) Empowerment Beliefs Index
Intervention	0.658 (0.070) {0.000}*** {0.001}***	0.686 (0.040) {0.000}*** {0.001}***	0.214 (0.075) {0.102} {0.008}***	0.389 (0.165) {0.183} {0.015}**
Control Mean	0.138	0.102	-0.000	-0.000
Observations	1056	1029	1039	1064
Pair FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes

*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, whether the girl is unmarried at endline, whether the girl self-reports being enrolled in school at endline, an index measuring financial behavior in terms of planning and savings behavior. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) wild cluster bootstrap p-values are reported in brackets following Cameron et al. (2008) and Roodman et al. (2019); iv) q-values are reported in braces based on two-sided tests adjusted to control for the false discovery rate (or the proportion of Type I errors) following Benjamini et al. (2006) and Anderson (2008); and v) control means are computed using endline data for the control group in the estimation sample.

Table III: Effects of Pathways on Schooling

	(1) In School (d)	(2) Schooling Index	(3) Want Higher Ed (d)	(4) Younger Sister In School (d)
Intervention	0.686 (0.040) [0.000]*** {0.001}***	1.900 (0.385) [0.000]*** {0.001}***	0.425 (0.085) [0.000]*** {0.001}***	0.285 (0.039) [0.000]*** {0.001}***
Control Mean	0.102	-0.000	0.364	0.282
Observations	1029	1065	513	757
Pair FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes

*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, specifically whether the girl self-reports being enrolled in school at endline, an index measuring schooling intensity, whether the girl reports that she is interested in pursuing higher education, and whether the girl self-reports that a younger sister in her house is attending school. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) wild cluster bootstrap p-values are reported in brackets following Cameron et al. (2008) and Roodman et al. (2019); iv) q-values are reported in braces based on two-sided tests adjusted to control for the false discovery rate (or the proportion of Type I errors) following Benjamini et al. (2006) and Anderson (2008); and v) control means are computed using endline data for the control group in the estimation sample.

Table IV: Mediated Effects of Pathways

	Unmarried (d)			
	(1)	(2)	(3)	(4)
Intervention	0.569*** (0.067)	0.461*** (0.060)	0.569*** (0.066)	0.459*** (0.060)
Control Mean	0.138	0.138	0.138	0.138
Observations	1018	1018	1011	1011
Pair FE	Yes	Yes	Yes	Yes
Mediators	School Only	School Only	Multiple	Multiple
Interacted Mediators	No	Yes	No	Yes
Share Explained	0.122	0.289	0.122	0.291

*Note:* This table presents mediated treatment effect estimates for the Pathways intervention marriage outcomes, following the sequential  $g$ -estimation method outlined in Acharya et al. (2016). The mediators accounted for are school attendance in columns (1) and (2), and school attendance, social support, gender empowerment norms, and self-perception in columns (3) and (4). In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all non-meditating variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) all variables enter the mediation analysis linearly, with one specification also including interactions between the mediator and the treatment indicator; iv) p-values are based on two-sided tests; and v) control means are computed using endline data for the control group in the estimation sample.

Table V: Effects of Pathways on Community Outcomes

	(1) Desired Marriage Age	(2) Social Support Index
Intervention	4.704 (0.860) [0.000]*** {0.001}***	0.426 (0.151) [0.065]* {0.006}***
Control Mean	18.041	0.000
Observations	414	1059
Pair FE	Yes	Yes
Covariates	Yes	Yes

*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, specifically girls' desired marriage age and an index measuring social support. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) wild cluster bootstrap p-values are reported in brackets following Cameron et al. (2008) and Roodman et al. (2019); iv) q-values are reported in braces based on two-sided tests adjusted to control for the false discovery rate (or the proportion of Type I errors) following Benjamini et al. (2006) and Anderson (2008); and v) control means are computed using endline data for the control group in the estimation sample.

Table VI: Effects by Community Heterogeneity

	(1) Unmarried (d)	(2) In School (d)	(3) Unmarried (d)	(4) In School (d)
Intervention	0.641 (0.041) [0.000]*** {0.001}***	0.676 (0.021) [0.000]*** {0.001}***	0.665 (0.069) [0.000]*** {0.001}***	0.681 (0.040) [0.000]*** {0.001}***
Int x Average Age of Other Group Mates	-0.330 (0.105) [0.172] {0.013}**	-0.019 (0.052) [0.809] {0.554}		
Int x Nr Girls with Same Father			0.070 (0.026) [0.081]* {0.032}**	0.031 (0.028) [0.452] {0.167}
Control Mean	0.138	0.102	0.138	0.102
Observations	1056	1029	1049	1023
Pair FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes

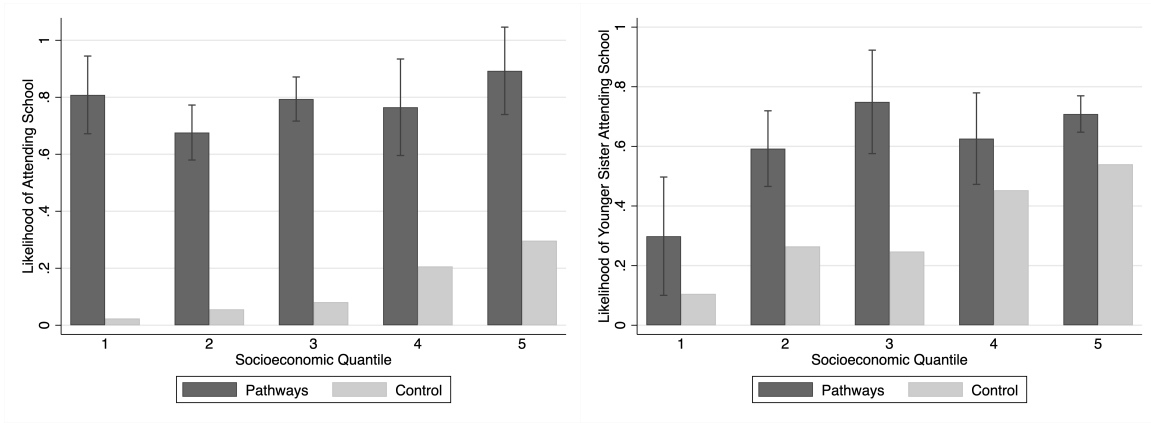
*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, assessing interaction effects with the mean age of participants' group mates and with the number of girls with the same father's name enrolled in the program. Outcomes include whether the girl is unmarried at endline and whether the girl self-reports being enrolled in school at endline. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline, plus either the (demeaned) age of the respondent at baseline or the (demeaned) number of girl siblings the girl has and the number of girl siblings interacted with treatment; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) wild cluster bootstrap p-values are reported in brackets following Cameron et al. (2008) and Roodman et al. (2019); iv) q-values are reported in braces based on two-sided tests adjusted to control for the false discovery rate (or the proportion of Type I errors) following Benjamini et al. (2006) and Anderson (2008); and v) control means are computed using endline data for the control group in the estimation sample.



Table VII: Effects of Pathways on Self-Advocacy

	(1) Marriage Self-Advocacy	(2) Schooling Self-Advocacy	(3) Self Perception
Intervention	0.762 (0.186) [0.001]*** {0.003}***	0.452 (0.128) [0.028]** {0.003}***	0.577 (0.160) [0.006]*** {0.003}***
Control Mean	-0.000	-0.000	-0.000
Observations	775	552	1058
Pair FE	Yes	Yes	Yes
Covariates	Yes	Yes	Yes

*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, specifically an index of marriage self-advocacy, an index of schooling self-advocacy, and an index of self-perception. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) wild cluster bootstrap p-values are reported in brackets following Cameron et al. (2008) and Roodman et al. (2019); iv) q-values are reported in braces based on two-sided tests adjusted to control for the false discovery rate (or the proportion of Type I errors) following Benjamini et al. (2006) and Anderson (2008); ; and v) control means are computed using endline data for the control group in the estimation sample.



(a) Participants

(b) Younger Sisters

Figure VII: School Treatment Effects by Socio-economic Status

## A Supplementary Tables

Table A.1: Interventions for Comparison to Pathways

Paper	Country	Intervention	Time
Ashraf et al. (2020)	Zambia	Negotiation training	3 years
Ashraf et al. (2020)	Zambia	Safe spaces	3 years
Angrist et al. (2003)	Colombia	Vouchers to private school	1-5 years
Baird et al. (2011)	Malawi	Conditional cash transfers	2 years
Baird et al. (2011)	Malawi	Unconditional cash transfers	2 years
Bandiera et al. (2020)	Uganda	Safe spaces (ELA)	2 years
Buchmann et al. (2021)	Bangladesh	Cond. incentives	3 years
Buchmann et al. (2021)	Bangladesh	Safe spaces	3 years
Buehren et al. (2017)	Tanzania	Safe spaces (ELA)	2 years
Buehren et al. (2017)	Tanzania	Safe spaces (ELA) + loans	2 years
Duflo et al. (2015)	Kenya	Free school uniforms	3 years
Jensen (2012)	India	BPO jobs	3 years

Table A.2: Missings Table

Variable	Non-Missing Obs	Treated	p-value
Girl is Unmarried (d)	1056	.017	0.739
Girls Attends School (d)	1029	-.036	0.613
Self Perception Index	1058	0.00	0.910
Social Support Index	1059	0.00	0.973
Empowerment Beliefs Index	1064	0.00	0.954
Financial Behavior Index	1039	0.00	0.937
Marriage Self-Advocacy Index	775	-.121	0.493
School Self-Advocacy Index	552	.071	0.700
Younger Sister in School (d)	757	.105	0.382
Educational Intensity Index	1065	0.00	0.929
Desired Age of Marriage	414	-.128	0.452

Note: This table presents missing balance for the Pathways intervention at the endline survey, meaning each row represents a regression of whether a given outcome was missing or not on a treatment indicator. The total number of girls in the sample was 1,171, of whom 1,066 took the survey. In this analysis: i) p-values are calculated based on two-sided tests using robust standard errors are clustered at the community level; and ii) indices, where indicated, are constructed following Anderson (2008) and expressed in standard deviation units.

Table A.3: Effects of Pathways - Varying Controls

Outcome variable	Control mean	Covariates			N
		None	Main	All	
Girl is Unmarried (d)	0.138	0.654 (0.062)	0.658 (0.070)	0.670 (0.036)	1056
Girls Attends School (d)	0.102	0.720 (0.039)	0.686 (0.040)	0.689 (0.028)	1029
Financial Behavior Index	0.000	0.209 (0.096)	0.214 (0.075)	0.236 (0.070)	1039
Empowerment Beliefs Index	0.000	0.357 (0.193)	0.389 (0.165)	0.396 (0.091)	1064

Note: This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls. In this analysis: i) robust standard errors clustered at the community level are indicated in parenthesis beneath the coefficients, ii) indices, where indicated, are constructed following Anderson (2008) and expressed in standard deviation units; and iii) all specifications include pair fixed effects, but otherwise vary, with the left specification including only the baseline measure of the outcome, the center specification including the baseline measure of the outcome and controls for all variables unbalanced at baseline, and the right specification including baseline measures of all covariates listed in Table 1.

Table A.4: Effects of Pathways

	(1) Unmarried (d)	(2) In School (d)	(3) Financial Behavior Index	(4) Empowerment Beliefs Index
Intervention	0.658 (0.070) [0.000]***	0.686 (0.040) [0.000]***	0.214 (0.075) [0.467]	0.389 (0.165) [0.263]
Control Mean	0.138	0.102	-0.000	-0.000
Observations	1056	1029	1039	1064
Pair FE	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes

Note: This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls, whether the girl is unmarried at endline, whether the girl self-reports being enrolled in school at endline, an index measuring financial behavior in terms of planning and savings behavior. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level; iii) randomization inference p-values, clustered by community and stratified by pair, with 1,000 replications are computed following Athey and Imbens (2017) and reported in curly brackets; and iv) control means are computed using endline data for the control group in the estimation sample.

Table A.5: Effects of Pathways Selected Outcomes by State

	Desired Age of Marriage		
	(1)	(2)	
Intervention	7.297*** (0.333)	1.206 (0.690)	
Control Mean	15.713	20.883	
Observations	273	141	
	Marriage Self-Advocacy Index		
	(1)	(2)	(3)
Intervention	1.268*** (0.210)	0.214 (0.096)	0.758** (0.238)
Control Mean	-0.116	0.189	-0.163
Observations	378	264	133
	Schooling Self-Advocacy Index		
	(1)	(2)	(3)
Intervention	0.518** (0.209)	0.423* (0.144)	-0.454** (0.108)
Control Mean	-0.174	0.524	-0.187
Observations	377	135	40
State	Borno	Kano	Kaduna
Sample by State	380	397	394
Pair FE	Yes	Yes	Yes
Covariates	Yes	Yes	Yes

*Note:* This table presents treatment effect estimates for the Pathways intervention on the behavior and attitudes of adolescent girls by state. In this analysis: i) all specifications include pair fixed effects, the baseline measure of the outcome and controls for all variables unbalanced at baseline, plus the age of the respondent at baseline; ii) robust standard errors, reported in parenthesis, are estimated clustered at the community level.

## B Data Construction

This appendix contains details on the construction of variables used in the analysis of the Pathways program, in particular the construction of indices used for outcome analysis, baseline balance and heterogeneity analysis. The construction of these indices follows Anderson (2008), with measures standardized relative to the control group before being combined into aggregate measures.

Educational intensity index:

- Daily hours spent on school
- Would like to attend education beyond senior secondary (d)
- Terms completed in current school year

Marriage self-advocacy index:

- Could discuss desired age of marriage with familial decision-maker (d)
- Could convince familial decision-maker to delay marriage (d)
- Discussed desired age of marriage with familial decision-maker (d)
- Planned to discuss desired age of marriage with familial decision-maker (d)
- Asked someone to discuss desired age of marriage with familial decision-maker (d)
- Planned to ask someone to discuss desired age of marriage with familial-decision maker (d)

School self-advocacy index:

- Could have discussed level of desired schooling with familial decision-maker (d)
- Could convince familial decision-maker to agree to level of desired schooling (d)
- Discussed level of desired schooling with familial decision-maker (d)
- Planned to discuss level of desired schooling with familial decision-maker (d)
- Asked someone to discuss level of desired schooling with familial decision-maker (d)
- Planned to ask someone to discuss level of desired schooling with familial decision-maker (d)

Financial behavior index:

- Currently saves money (d)
- Tracks how much money she earns (d)
- Tracks money she spends (d)
- Plans ahead for spending earned money (d)

- Has money for emergency (d)

Self perception index:

- Strongly agrees with statement: “Your parents/family listens to you when you speak” (d)
- Strongly agrees with statement: “Your parents/family takes your concerns into account when making decisions” (d)
- Strongly agrees with statement: “Your parents/family trusts you with important tasks for the household (such as caring for children, taking care of livestock, or generating income)” (d)
- Strongly agrees with statement: “You feel as important as other members of your family” (d)
- Strongly agrees with statement: “People like you can make a positive impact in the community” (d)

Social support index:

- Strong agrees with statement: “Your family really tries to help you” (d)
- Strongly agrees with statement: “You get the emotional help and support you need from your family” (d)
- Strongly agrees with statement: “Your friends really try to help you” (d)
- Strongly agrees with statement: “You can count on your friends when things go wrong” (d)
- Strongly agrees with statement: “You can talk about your problems with your family” (d)
- Strongly agrees with statement: “You have friends with whom you can share your joys and sorrows” (d)
- Strongly agrees with statement: “Your family is willing to help you make decisions” (d)
- Strongly agrees with statement: “You can talk about your problems with your friends” (d)
- Number of non-family female friends

Empowerment beliefs index:

- Disagree with statement: “It is important that sons have more education than daughters” (d)
- Disagree with statement: “Daughters should be sent to school only if they are not needed to help at home” (d)
- Disagree with statement: “The most important reason that sons should be more educated than daughters is so that they can better look after their parents when they are older” (d)
- Disagree with statement: “If there is a limited amount of money to pay for tutoring, it should be spent on sons first” (d)
- Disagree with statement: “A woman should take good care of her own children and not worry about other people’s affairs” (d)

- Disagree with statement: “Woman should leave politics to the men” (d)
- Disagree with statement: “A woman has to have a husband or sons or some other male kinsman to protect her” (d)
- Disagree with statement: “The only thing a woman can really rely on in her old age is her sons” (d)
- Disagree with statement: “A good woman never questions her husband’s opinions, even if she is not sure she agrees with them” (d)
- Disagree with statement: “When it is a question of children’s health, it is best to do whatever the father wants” (d)

Household asset index:

- Floor made of material other than earth (d)
- Roof metal of metal or cement (d)
- Uses water from safe source (d)
- Uses wood or gas as fuel (d)
- Has toilet in house (d)
- Has radio (d)
- Has phone (d)
- Has electricity (d)
- Has television (d)
- Has fridge (d)
- Has bicycle (d)
- Has motorcycle (d)
- Has car (d)
- Has canoe (d)
- Has boat with motor (d)
- Has animal drawn cart (d)
- Has generator (d)
- Has computer (d)

Socioeconomic index:

- Mother is literate in at least one language (d)
- Father is literate in at least one language (d)
- Father works in non-agricultural sector (d)
- Asset index measuring normalized ownership of radio, phone, electricity, television, refrigerator, bicycle, motorcycle, car, canoe, boat, cart, generator and computer



## C Benefit-Cost Analysis

We use a benefit-cost analysis framework to estimate the cost-effectiveness of the Pathways to Choice intervention, closely following Field et al. (2016). Specifically, we focus on the cumulative education wage premium for girls who complete the program. We assume that girls start “working” at the age they enter marriage in Nigeria, estimated to be 17 based on the 2019 Living Standards Survey (LSS) in Nigeria, and continue working until they are 60. We assume that wage returns to education are constant across the girls’ working life, and that returns to years of secondary education are equal for women in and out of the workforce. We assume that extra education delays the entry of girls into the workforce, and that they begin working immediately after finishing their studies.

We follow Montenegro and Patrinos (2014) in estimating the returns to education and experience using a modified Mincer approach. Specifically, using a sample of girls in Northern Nigeria, we estimate the returns to education and experience as follows:

$$\ln(W_i) = \alpha + \beta_S S_i + \beta_E E_i + \beta_E E_i^2 + \mu_i$$

where  $w_i$  is wage,  $S_i$  is years of schooling, and  $E_i$  is labor market potential experience (estimated as  $\text{age}_i - \text{median marriage age}$  based on entry into the labor force), and  $E_i^2$  is potential experience-squared. Inherent in these estimates is the assumption that education increases productivity equally for women working for a wage and not earning a wage.

We then modify this equation to allow us to calculate a girl’s income in a given year. For girls in the control group ( $C$ ), income in each year  $t$  is estimated as:

$$\text{Income}_t^C = \prod_{k=1}^t (1 + \rho_k) * e^{(\alpha + \beta_S(\text{median schooling}) + \beta_E(t - \text{median marriage age}) + \beta_{E2}(t - \text{median marriage age})^2)}$$

For girls receiving the intervention ( $I$ ), income in each year  $t$  is estimated as:

$$\text{Income}_t^I = \prod_{k=1}^t (1 + \rho_k) * e^{(\alpha + \beta_S(\text{median schooling} + \lambda) + \beta_E(t - \text{median marriage age} - \lambda) + \beta_{E2}(t - \text{median marriage age} - \lambda)^2)}$$

where  $\lambda$  is the point estimate for the education benefit of the program. A comparison between the two therefore takes into account both the educational income premium from additional years of schooling, as well as the loss of work experience due to staying in school.

We also estimate the income in each year  $t$  for a girl who participates in the program but receives no educational benefit ( $N$ ), allowing us to calculate the cost to the girl separate from the implementation cost. This is estimated as:

$$\text{Income}_t^N = \prod_{k=1}^t (1 + \rho_k) * e^{(\alpha + \beta_S(\text{median schooling}) + \beta_E(t - \text{median marriage age} - \lambda) + \beta_{E2}(t - \text{median marriage age} - \lambda)^2)}$$

where  $\lambda$  is the point estimate for the education benefit of the program.

This allows us to determine the benefit per eligible girl, which is the difference between a girl who participated and received the benefit ( $\text{Income}_t^I$ ) and who participated and did not receive the benefit ( $\text{Income}_t^N$ ). The cost per eligible girl, on the other hand, is the difference between a girl who did not participate ( $\text{Income}_t^C$ ) and a girl who participated and did not receive the benefit ( $\text{Income}_t^N$ ). Additionally, we add in the costs to the implementor.

The present value of benefits (costs) of each program are then defined as:

$$\text{Present Value of Benefits (Costs)} = \sum_{t=0}^T \frac{\text{Annual Program Benefits (Costs)}_t}{(1 + \theta)^t}$$

where  $T$  is the years from the beginning of the intervention to the end of a woman's working life and  $\theta$  is the social discount rate. These results use a social discount rate of 5%.

Following this framework, we construct specific indicators. Specifically, we calculate the benefit-cost ratio by dividing the present value of benefits per girl per the present value of costs per girl. We construct the net present value as the difference between the total present value of the benefits of the program and the net present value of the costs, and present it for the program in terms of NPV per \$1,000 invested, taking into account implementor costs and costs to the girls. In other words, we re-scale the total net present value of the girls relative to the total cost of the program, as net present value may vary by program size. This results in a net present value of \$1,627 per \$1,000 invested.

As well, we calculate two more direct measures of program impact, which require fewer assumptions: the cost-effectiveness of the program in terms of years of delayed marriage and additional years of schooling, each in two different ways. Specifically, we compare the amount of each outcome relative to per \$1,000 spent (using both foregone income and implementation costs). We start with the point estimate of years of delayed marriage (additional schooling) and multiply it by the number of girls who participated in the intervention. This gives us the total years of delayed marriage (additional schooling), which we then divide by the costs of the program in \$1,000 to express the figure as returns to \$1,000 spent. We also present the same numbers relative to \$1,000 invested (using only implementor costs), which looks only at returns to implementor funds rather than broad societal benefits.