Beattie TS, Prakash R, Javalkar P, et al. Assessing the effect of the Samata intervention on factors hypothesised to be on the pathway to child marriage and school drop-out: results from a cluster-randomised trial in rural north Karnataka, India. *Journal of Global Health Reports*. 2020;4:e2020019. doi:10.29392/001c.12345

Research Articles

Assessing the effect of the Samata intervention on factors hypothesised to be on the pathway to child marriage and school drop-out: results from a cluster-randomised trial in rural north Karnataka, India

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Keywords: secondary school, child marriage, cluster randomised controlled trial, adolescent

https://doi.org/10.29392/001c.12345

Journal of Global Health Reports

Vol. 4, 2020

Background

We implemented a comprehensive intervention (Samata) to address school drop-out and child marriage among rural, marginalised adolescent girls in north Karnataka, south India. Here, we investigate (i) the impact of the intervention on factors hypothesised at baseline to be on the pathway to preventing school drop-out and child marriage, and (ii) associations between these factors and secondary school completion and child marriage.

Methods

Data was collected for a cluster-RCT evaluation. Factors hypothesised to be on the pathway to improving secondary school retention and delaying age at marriage included: (i) uptake of skills and training by adolescent girls; (ii) uptake of government school scholarships by families of adolescent girls; (iii) gender equitable attitudes among girls; (iv) reduced harassment by boys; and (v) an enabling school environment. Analyses used individual-level cluster-RCT survey data, were intention-to-treat and used mixed-effects logisitic regression models.

Results

92.6% (2257/2457) of girls participated at baseline (13-14 years) and 72.8% (1788/2457) participated at end-line (15-16 years). At end-line, uptake of skills and training, gender equitable attitudes around marriage, and recent harassment by boys were significantly higher among girls in the intervention arm but there was no difference in uptake of government school scholarships, gender equitable attitudes around education or eve-teasing, or an enabling school environment by trial arm. Out-of-school/married girls were significantly less likely to have accessed skills or training, to have attended empowerment groups or to have made new friends (past year). They had lower levels of self-efficacy and were twice as likely to report having no hope for the future compared with their in-school/unmarried counterparts.

Conclusions

Samata was implemented in a context of substantial secular change across India; impacting on some of the factors hypothesised to be on the pathway was not sufficient to improve secondary school retention or delay marriage beyond what was already occurring. School dropout and child marriage were associated with diminished opportunities and well-being among girls. Targeted interventions are still needed; learnings from our study can be used to inform future interventions which similarly aim to impact on child marriage and secondary school retention within programmatic timeframes.

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Child marriage (<18 years) and secondary school dropout are both associated with adverse economic and health outcomes and particularly affect adolescent girls in low- and middle-income countries (LMIC).[1,2] An estimated 15 million girls are married before the age of 18 each year globally, with one third of girls married before 18 years in LMIC.[3] Child marriage rates are high in India, with 47% of women married by 18 years, and child marriage twice as likely in rural compared with urban areas.[3] Child brides are more likely to experience physical or sexual intimate partner violence, to face health risks from early pregnancy, and to leave education early.[4–6]

In addition to economic benefits, participation in secondary education is strongly associated with reductions in adolescent birth rates, mortality rates among 15-19 year old boys and girls, and maternal mortality among 15-24 year olds.[3] While there has been significant progress in recent years in increasing enrolment and retention in primary school, among those countries with available data, India has the highest number of out-of-school adolescents, globally, with 11.1 million adolescents of lower secondary school age and 46.8 million of upper secondary age estimated to be out-of-school in 2013.[7] Although wealth parity – which ranges from 0 (extreme inequality) to 1 (equality) in terms of primary school attendance is close to achievement in South-Eastern Asia, this reduces to 0.89 among lower secondary age and to 0.63 of upper secondary age.[7]

Samata was a 3-year programme implemented in two rural districts in North Karnataka, south India, which aimed to reduce child marriage, prevent entry into sex work and increase entry into and completion of secondary school among adolescent girls from the most economically marginalised castes (scheduled caste/scheduled tribe (SC/ST)).[8] Before designing the intervention, the Karnataka Health Promotion Trust (KHPT) programme team responsible for implementing the HIV prevention programme in north Karnataka, together with the researcher team, met and discussed the HIV-related risks and vulnerabilities among FSWs in this region, and possible approaches to reduce these risks. A key concern was early marriage, sex trafficking, and early sexual debut (12-13 years) among girls from the sex work community. Drawing on previous work which aimed to understand the needs of sex workers' children (girls) in north Karnataka,[9] we hypothesised at study start that supporting girls to remain in secondary school would help delay age at marriage, delay sexual debut and prevent entry into sex work. It would also provide them with better skills to negotiate their rights and assert their needs and aspirations, which in turn would improve their overall wellbeing.

We developed a Theory of Change (**Figure 1**) which identified various factors at the individual, community and structural levels hypothesised to be on the pathway to achieving the programme aims.

At the girl level, we hypothesised that (i) uptake of skills and training; (ii) uptake of government school scholarships by families; (iii) gender equitable attitudes among girls; (iv) reduced harassment by boys; and (v) the creation of an enabling school environment, would all be important in increasing secondary school retention and delaying age at marriage. We developed an intervention which worked with low caste adolescent girls and their families, adolescent boys, village communities and leaders, school staff and governing committees and policy makers and implementers, the details of which have previously been published.[8] By working with different stakeholders to address these factors, we aimed to impact on child marriage and secondary school retention in this setting. Previously we reported no overall impact of the *Samata* programme on child marriage or secondary school dropout, although we did see an impact on schooling outcomes in one district; prevalence of child entry into sex work was too low to be included as a primary outcome.[10] The aim of this current paper was (i) to explore the impact of the intervention on these hypothesised pathway factors, and (ii) to examine if these factors were indeed associated with the trial primary outcomes (secondary school completion; child marriage) at endline.

METHODS

STUDY SETTING

This trial took place among scheduled caste (scheduled tribe) girls and their families in two rural districts (Bagalkote and Villaypura) in Northern Karnataka, South India. These districts border the neighbouring state of Maharastra and were selected due to high levels of poverty and seasonal migration, and the tradition of *Devadasi* sex work – whereby girls from devadasi families were dedicated to temples at a young age and once they reached menarche, began socially sanctioned sex work.[11] These districts have been previously characterised by high levels of HIV among women who sell sex and a culture of 'missing girls', whereby girls who reached menarche were no longer found in their natal homes (having left due to marriage or to start sex work).[12,13] Secondary school entry and completion among SC/ST girls were the lowest in the state, compared with higher castes, girls living in urban areas and compared with boys.[14] We hypothesised that supporting girls to finish their secondary education would have economic and health benefits for themselves and their children, and would also delay their age at marriage and prevent or delay the start of sex work.

PARTICIPANTS

All SC/ST girls living in 80 village clusters and enrolled in the final year of primary school (aged 11-12 years), were eligible for study enrolment. Participants were enrolled in two consecutive cohorts, one academic year apart (2012/13 and 2013/14). Cross-sectional baseline surveys were conducted in February-June 2014 (*cohort 1*) when girls were in their final term of the first year of secondary school, and July-September 2014 (*cohort 2*), when girls were in their first term of secondary school. The intervention was delivered to all SC/ST girls aged 13-16 years in the intervention villages, regardless of whether they were enrolled in the study. Although girls were expected to receive 36 months of intervention activities, due to funding issues, *cohort 1* girls received 18 months of intervention exposure (starting when they were in year 9) and *cohort 2* girls received 30 months of intervention exposure (starting when they were in year 8). End line surveys were conducted in May-July 2016 (*cohort 1*) and May-July 2017 (*cohort 2*), after their secondary school final exams.

The evaluation design involved a two-arm cluster-randomised controlled trial with parallel assignment (**Figure 2**) and has been previously described.[8] From a sample frame of 121 villages, 80 village clusters (40 intervention, 40 control) were randomly selected, encompassing 296 villages (119 intervention, 177 control) and 129 secondary schools (69 intervention, 60 control). A 'village cluster' comprises one 'main' village with one or more eligible high-schools plus the surrounding 'feeder' villages, which do not contain a

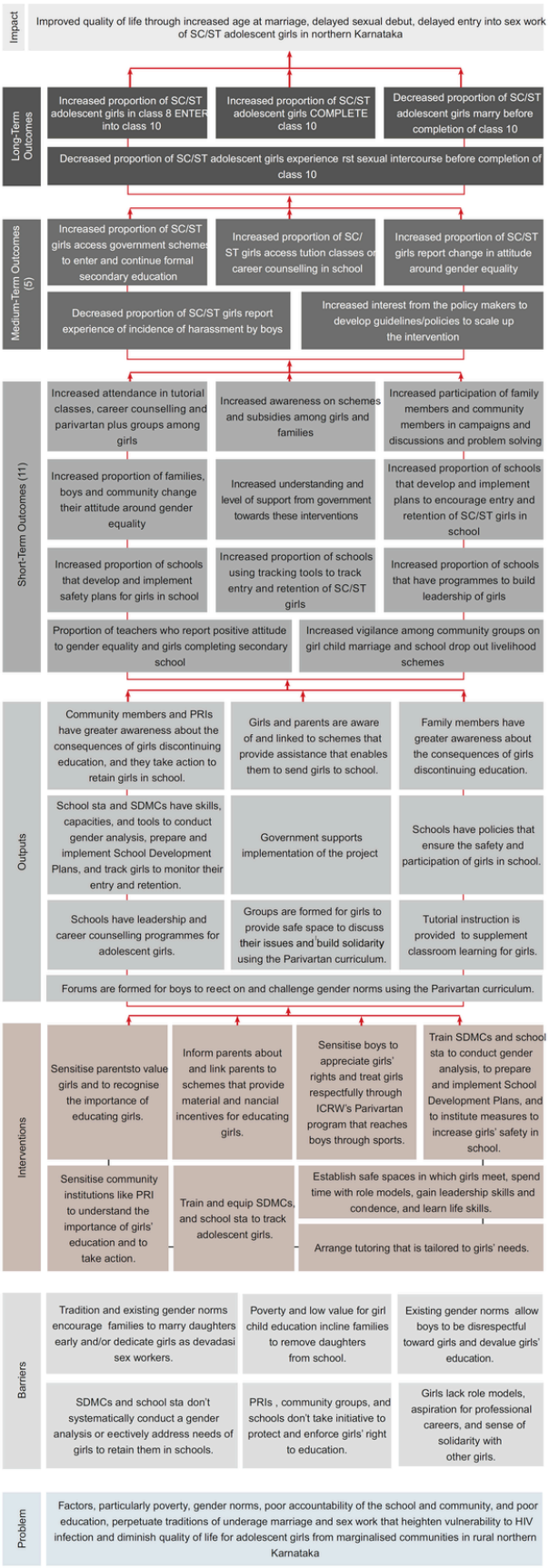

Figure 1. *Samata* Theory of Change.

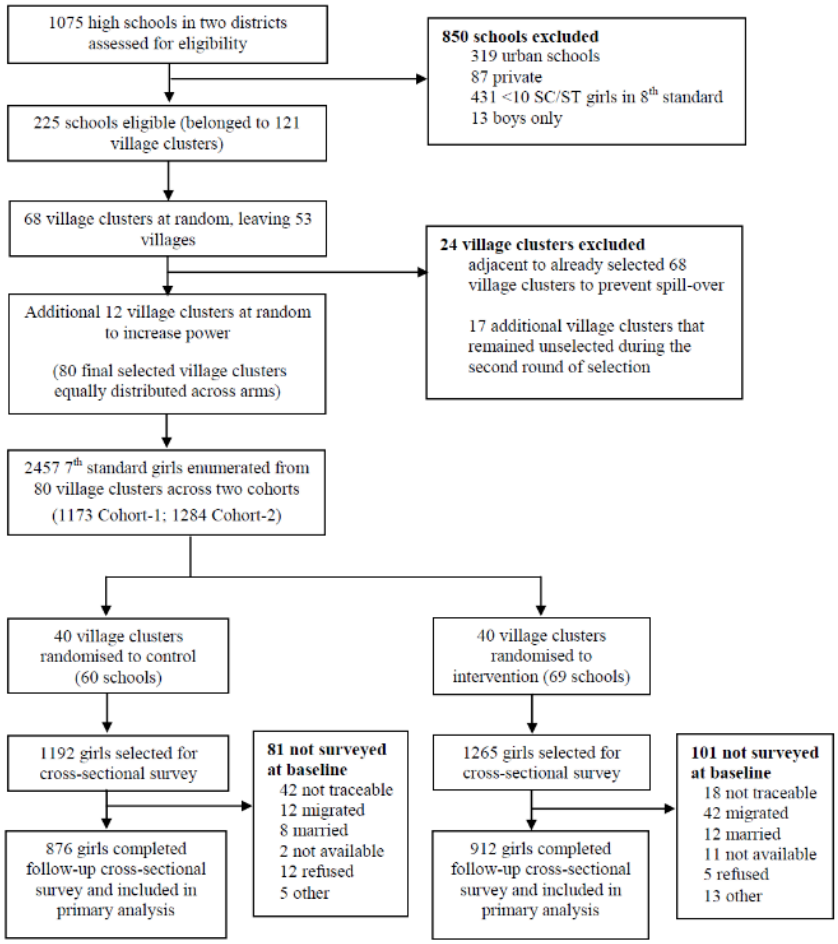

Figure 2. Trial profile.

high-school but have SC/ST adolescents living there who attend the high-school in the 'main' village. All SC/ST girls in the final year of primary school (7th standard) were eligible for trial enrolment. The two primary trial outcomes were (i) completion of secondary school (sit 10th standard exam) and (ii) marriage [by trial end line].

ETHICS

Parents/guardians provided written informed consent, and adolescent girls provided written informed assent, for their participation in the study. The surveys were administered by trained female field investigators and all interviews were conducted in *Kannada* (the local language) in a private setting. Repeat visits were made to find girls who were not available on the survey day. Interviewers referred girls needing help or counselling support to the nearest *Santhwana* Centre (government-funded centres providing financial and emotional support to women experiencing violence, forced marriage, and other gender-based issues). The study was approved by ethics committees at St John's Medical College, Bangalore, London School of Hygiene & Tropical Medicine, and the University of Manitoba. The study protocol was registered at clinicaltrials.gov (NCT01996241).

VARIABLES

The questionnaire comprised three parts: a brief demographic and economic questionnaire asked to an adult family member; a structured questionnaire asked by a female in-

terviewer to adolescent girls in private in their own homes; and an anonymous short self-completed questionnaire containing sensitive questions (menarche, eve-teasing) that girls completed by themselves (or in the case of low literacy levels, with the assistance of interviewers) (Appendices S1-3 in the **Online Supplementary Document**). Questionnaires were translated into *Kannada* and pre-tested with SC/ST adolescent girls of the same age from non-trial villages, before being finalised for the survey.

Information on household sociodemographic characteristics (caste, orphan hood, household assets, and literacy status of household head) were collected from an adult family member. Data were collected from adolescent girls on her age, devadasi status, and whether she had had her first menstrual period.

Information on (i) skills and training; (ii) government schemes (scholarships) supporting continuation in secondary education; (iii) gender attitudes; (iv) harassment by boys; and (v) the school environment, were collected from adolescent girls as follows. (i) In the face-to-face interviews, girls were asked about their uptake of skills and training currently (tutorial classes) and ever (career counselling, life skills training, leadership skills training). Each was coded as a binary variable (Y/N). To understand attendance at various groups, we asked about frequency of attendance at lifeskills education, savings groups, or kishori groups, and created a binary variable (attended one or more of these groups almost every day/ at least once a week/at least once a month vs. less often/not at all); and attendance (ever) at the *Samata* Intervention Parivartan Plus Group Sessions (Y/N). (ii) Currently accessing government scholarships for high school going girls/accessing at time when dropped out of school was assessed with a binary question (Y/N). (iii) Girls attitudes around marriage, education, eve teasing and mobility were assessed through a series of statements asked on a three-point likeart scale (disagree, somewhat agree, agree). We re-coded these to make a binary variable (disagree vs. somewhat agree). (iv) Recent 'eve teasing' (Y/N) was defined as 'yes' if girls reported being sexually harassed or teased in the past 12 months.[15] (v) We defined her current (or last) school as having a harassing or bullying school environment if she responded yes to any of the following: sexual harassment of girls by other students; sexual harassment of girls by teachers/staff; bullying by other students. We defined her current (or last) school as having harsh physical punishment by teachers if she responded yes to a binary (Y/N) question on this.

Although not specified in the *Theory of Change*, in our final analyses examining associations between factors hypothesised to be on the pathway and child marriage or school drop-out, we were also interested to understand differences in levels of self-efficacy, activism (speaking out against gender disadvantage) and hope for the future between unmarried or in-school girls, and those who were married or out-of-school. Self-efficacy and activism were previously defined at trial baseline, and were derived using PCA and internal consistency analyses on responses to seven item and three item scales, respectively.[15] Both scales used a three-point likert type response choice (Agree/ somewhat agree/ do not agree). The Chronbach's Alpha for the responses to the 7 item self-efficacy scale and the 3-item speaking out against gender disadavantage scale were 0.67 and 0.78, respectively. Girls' scores for each scale were summed, the total score divided into tertiles, and coded as binary variables (low vs. medium/high) in the analyses. 'I have no hope for the future' was measured using a three-item likeart scale and then re-coded as a binary variable (disagree vs. somewhat agree/agree).

STATISTICAL ANALYSIS

All analyses were done in STATA (version 14.0; StataCorp, College Station, TX, USA; licensed to Tara Beattie (LSHTM)). We pooled data from cohort 1 and cohort 2 at both baseline and endline, and did an intention-to-treat analysis using individual-level girl data, accounting for clustering of girls within villages. To examine the impact of the intervention at endline on factors hypothesised to be on the pathway to school dropout or child marriage – i.e. (i) uptake of skills and training; (ii) government schemes (scholarships) supporting continuation in secondary education; (iii) gender attitudes; (iv) harassment by boys; and (v) the school environment – we compared the proportion of girls reporting these outcomes at endline in the intervention compared with the control arm. The analysis used mixed-effects logistic regression models and the statistical test for comparing groups was the Wald test. Unadjusted analyses of outcomes controlled for village strata at baseline. Adjusted analyses controlled additionally for village type (feeder vs. main), caste, literacy status of the household head at endline, and cluster level mean at baseline of exposure variable.

To examine if the factors hypothesised to be on the pathway to child marriage and school dropout – ie, i) uptake of skills and training; (ii) government schemes (scholarships) supporting continuation in secondary education; (iii) gender attitudes; (iv) harassment by boys; and (v) the school environment and child marriage and school drop-out - were indeed associated with secondary school dropout or child marriage, we used endline data. As the proportion of girls who were married or who had dropped out of school at endline did not differ by trial arm, we treated the endline data as if it were cross-sectional data and compared the proportion of girls reporting these factors who were in-school vs. dropped out of school and who were unmarried vs. married (regardless of trial arm). The analysis used individual-level girl data, accounting for clustering of girls within villages using mixed-effects logistic regression models. The statistical test for comparing groups was the Wald test. Unadjusted analyses controlled for village strata at baseline. Adjusted analyses controlled additionally for trial arm, district, study cohort, stratum, caste and literacy status of the household head at endline.

RESULTS

STUDY POPULATION

Of the total 2457 SC/ST girls enrolled in the trial, 2275 (92.6%) were interviewed at baseline (cohort 1=1084; cohort 2=1191) and 1788 (72.8%) were interviewed at endline (cohort 1=872; cohort 2=916). At baseline, sociodemographic characteristics of adolescent girls were well-balanced across trial arms (Table 1). Most girls were 13 years old and two thirds had started menstruating. 17% of girls had one or both parents deceased, 20% were from a household in the poorest quintile (relative to the rest of the study population) and nearly two thirds (63%) lived in a household with an illiterate household head. Slightly more girls lived in Bagalkote (55%) compared with Bijapur (45%) districts, and the majority of girls (70%) lived in a "main" village, with 30% living in a 'feeder' village. Most girls were from scheduled castes (79%) with the remainder from scheduled tribe (21%) and virtually all girls (99.8%) said they were not from

Table 1. Assessing imbalance in socio-demographic characteristics of adolescent girls (aged 13-14 years) across intervention and control arms at baseline

	% of the sample	Control	Intervention
Individual-level summary			
Total	**N=2275**	**N=1111**	**N=1164**
Cohort:			
One	47.7	49.1	46.3
Two	52.4	50.1	53.7
District:			
Bagalkote	55.3	55.8	54.9
Bijapur	44.7	44.2	45.1
Village type:			
Main	70.7	68.9	72.4
Feeder	29.3	31.1	27
Age (years):			
11-12 years	4.6	4.5	4.7
13 years	85.2	85.9	84.6
14+ years	10.2	9.6	10.7
Median (years)	13.0 (12-16)	13.0 (12-15)	13.0 (12-16)
Caste:			
Scheduled caste	78.6	81.0	76.2
Scheduled tribe	21.4	18.8	23.9
Devadasi:			
No	99.8	99.8	99.7
Yes	0.2	0.2	0.3
First menstrual period:			
No	32.7	32.0	
Yes	67.3	68.0	33.4
Orphan hood:			66.6
Both parents alive	83.3	83.7	83.0
One or both parents died	16.7	16.3	17.0
Household wealth quintile:			
Poorest	20.0	20.4	19.6
Poor	20.0	21.1	19.0
Median	20.0	19.7	20.3
Rich	20.0	18.1	21.8
Richest	20.0	20.7	19.3
Literacy of household head:			
Illiterate	62.7	60.3	64.9
Literate	37.3	39.7	35.1

a devadasi family.

INDIVIDUAL LEVEL UNADJUSTED AND ADJUSTED ANALYSES BY TRIAL ARM AT ENDLINE

At endline, to explore the impact of the intervention on factors hypothesised to be on the pathway to school dropout and child marriage, we examined (i) girl uptake of skills and training; (ii) uptake of government schemes to support continuation of education; (iii) girl's attitudes around gender equality; (iv) recent eve teasing experience; and (v) enabling school environment outcomes by trial arm, using individual data (**Table 2**). In adjusted analyses, we found that girls in the intervention arm were significantly more likely to report accessing skills and training and to report attendance at a lifeskills/saving/kishori group or an inter-

vention-delivered Parivartan plus girl empowerment group compared with girls in the control arm. We found no difference in the proportion accessing government schemes to support girl's continuation in education, with three-quarters of girls reporting accessing scholarships for school attendance. Girls in the intervention arm had more gender equitable attitudes around marriage (girls should have a say in who they marry; a wife should always obey her husband but there were no difference by trial arm for gender equitable attitudes around education, teasing or girl mobility) (**Table 2**). Girls in the intervention arm were significantly more likely to report eve teasing in the past year. The proportion reporting a harassing/bullying school environment or harsh physical punishment by teachers was low, with no difference by trial arm.

ASSOCIATIONS WITH CHILD MARRIAGE AND SECONDARY SCHOOL DROP-OUT

At trial end-line, 25% of girls did not complete secondary education, and 10% were married. We did not see changes at endline in either secondary school retention or child marriage, by trial arm.[10] However, having seen an impact of the intervention on some, but not all of the factors hypothesised to be on the pathway, we were interested to examine if the factors described above were indeed associated with these two trial primary outcomes at end-line (**Table 3**).

Girls who had dropped-out of school and girls who were married were significantly less likely to have accessed skills and training, career counselling, life skills training, leadership training compared with those who were in-school or unmarried, respectively, at endline (Table 3). They were also more likely to report not attending the empowerment groups held in the intervention villages (Parivartan Plus), or to have made new friends in the past 12 months. There was no difference in lifeskills/savings/kishori group attendance between in-school/out-of-school or unmarried/married girls, with >80% of all girls attending one of these groups at least monthly. Girls who had dropped out of school were less likely to have been accessing adolescent girl scholarship schemes when they were at school but there was no difference in scheme uptake between unmarried vs. married girls. In addition, girls who were in school were significantly more likely to support more gender equitable attitudes around marriage, education and girls mobility, compared with girls who had dropped out of school, but gender equitable attitudes were reasonably similar among unmarried compared with married girls, with the exception of attitudes around obedience within marriage (a wife should always obey her husband: unmarried 63% vs. married 86% agree/somewhat agree), and girls mobility (once a girl attains puberty, she shouldn't be allowed to roam free in the village: unmarried 46% vs. married 59% agree/somewhat agree) (Table 3). Recent eve teasing was more likely to be reported among girls in-school compared with girls out of school, but there was no difference in eve teasing rates in unmarried vs. married girls. The overall proportion reporting a harsh/bullying school environment (4.4%) or harsh physical punishment by teachers (6.2%) was quite low but rates were significantly higher among girls out of school compared with girls in school. There was no difference in these school-level factors between unmarried compared with married girls.

When we examined differences in levels of self-efficacy, activism (speaking out against gender disadvantage) and having hope for the future, we found that in adjusted analyses, girls who had dropped out of school or were married were significantly more likely to have low self-efficacy and low activism, and to report having no hope for their future, compared with girls who had were in school or unmarried, respectively.

Table 2. Individual-level analyses of pathway factors by trial arm, at endline

		Control %	Intervention %	Unadjusted Odds Ratio*	*P*-value	Adjusted Odds Ratio†	*P*-value
Uptake of skills and training:							
Currently attending tutorial classes	Yes	45.3	53.4	1.6 (1.1, 2.2)	0.014	1.5 (1.0, 2.1)	0.027
Ever availed career counselling	Yes	35.9	48.0	1.8 (1.4, 2.3)	<0.001	1.8 (1.4, 2.3)	<0.001
Ever availed life skills training	Yes	40.3	49.5	1.5 (1.0, 2.2)	0.049	1.5 (1.0, 2.2)	0.05
Ever availed leadership skills training	Yes	22.2	40.4	2.5 (1.9, 3.2)	<0.001	2.5 (1.9, 3.3)	<0.001
Lifeskills/savings /kishori group	Attend ≥monthly	78.0	85.0	1.6 (1.2, 2.1)	0.001	1.6 (1.2, 2.0)	0.002
Parivartan Plus Group	Attended group	11.9	63.2	13.4 (9.6, 18.6)	<0.001	12.7 (9.1, 17.6)	<0.001
Uptake of government schemes:							
Ag accessing scholarships	Yes	77.9	76.5	0.9 (0.6, 1.3)	0.5	0.9 (0.7, 1.3)	0.7
Gender attitudes:							
Marriage:							
Girls should have a say in who they marry	Somewhat agree/agree	93.9	96.0	1.6 (1.0, 2.7)	0.06	1.6 (1.0, 2.7)	0.05
A wife should always obey her husband	Somewhat agree/agree	68.5	62.2	0.8 (0.6, 0.9)	0.009	0.7 (0.6, 0.9)	0.001
It's OK for a husband to beat his wife if she has done something wrong	Somewhat agree/agree	68.6	63.7	0.8 (0.7, 1.0)	0.116	0.8 (0.7, 1.1)	0.13
Education:							
Daughters should be sent to school only if they're not needed to help at home	Somewhat agree/agree	13.0	15.3	1.2 (0.9, 1.6)	0.17	1.2 (0.9, 1.6)	0.14
Educated girls become rebellious and don't make good wives	Somewhat agree/agree	29.7	27.6	0.9 (0.7, 1.1)	0.3	0.9 (0.7, 1.1)	0.2
If there is limited money to pay for tutoring, it should be spent first on sons	Somewhat agree/agree	22.7	23.7	1.0 (0.8, 1.4)	0.7	1.0 (0.8, 1.4)	0.8
It is equally important to encourage daughters to get an education as it is with sons	Somewhat agree/agree	98.3	98.6	1.2 (0.5, 2.6)	0.7	1.3 (0.6, 2.9)	0.6
Teasing:							
Girls who are harassed or teased encourage it by the way they act or dress	Somewhat agree/agree	31.3	25.4	0.8 (0.6, 1.0)	0.065	0.9 (0.6, 1.3)	0.6
Mobility:							
Once a girl attains puberty, she shouldn't be allowed to roam free in the village‡	Somewhat agree/agree	49.1	45.4	0.8 (0.6, 1.1)	0.15	0.8 (0.6, 1.1)	0.1
Eve teasing:							
Sexually teased or hararassed past year	Yes	10.1	13.4	1.4 (1.0, 1.9)	0.03	1.4 (1.1, 1.9)	0.02
School environment:							
Harrassing/bullying school environment	Yes	3.9	4.8	1.3 (0.8, 2.2)	0.3	1.3 (0.8, 2.1)	0.3
Harsh physical punishment by teachers	Yes	5.9	5.6	0.8 (0.5, 1.5)	0.6	0.9 (0.5, 1.5)	0.6

*Adjusted for strata.

†Adjusted for village type (main vs. feeder), caste, literate household head (yes vs. no), strata, and cluster level mean at baseline of exposure variable).

‡AOR not adjusted for baseline cluster level mean as variable not asked at baseline.

Table 3. Individual-level associations between pathway and empowerment factors and secondary school retention or child marriage, at endline

		In school (n=1338)	Drop school (n=450)	Unadjusted Odds Ratio*	Adjusted Odds Ratio†		Unmarried (n=1612)	Married (n=176)	Unadjusted Odds Ratio*	Adjusted Odds Ratio†	
		%	%			*P* value	%	%			*P* value
Uptake of skills and training:											
Currently attending tutorial classes	Yes	57.8	24.4	0.2 (0.2, 0.3)	0.2 (0.2, 0.3)	<0.001	51.7	28.4	0.4 (0.3, 0.6)	0.4 (0.3, 0.6)	<0.001
Ever availed career counselling	Yes	50.2	18.0	0.2 (0.2, 0.3)	0.2 (0.1, 0.3)	<0.001	43.8	26.7	0.5 (0.3, 0.7)	0.5 (0.3, 0.7)	<0.001
Ever availed life skills training	Yes	51.8	20.1	0.2 (0.1, 0.3)	0.2 (0.1, 0.3)	<0.001	46.7	30.6	0.5 (0.3, 0.8)	0.5 (0.3, 0.8)	0.003
leadership	Yes	37.4	13.7	0.3 (0.2, 0.3)	0.3 (0.2, 0.3)	<0.001	33.0	17.3	0.4 (0.3, 0.6)	0.4 (0.3, 0.6)	<0.001
Lifeskills/savings /kishori group	Attend ≥monthly	80.9	83.3	1.2 (0.9, 1.6)	1.2 (0.9, 1.5)	0.4	81.5	81.8	1.0 (0.7, 1.6)	1.0 (0.7, 1.6)	0.9
Parivartan Plus Group	Attended group	46.6	12.7	0.09 (0.06, 0.1)	0.09 (0.06, 0.1)	<0.001	39.5	24.4	0.4 (0.3, 0.6)	0.4 (0.2, 0.6)	<0.001
Made new friends past 12 months	Yes	48.0	26.7	0.4 (0.3, 0.5)	0.4 (0.3, 0.5)	<0.001	43.6	33.5	0.7 (0.5, 0.9)	0.6 (0.4, 0.9)	0.007
Uptake of governmentschemes:											
Ag accessing scholarships	Yes	79.2	71.1	0.6 (0.5, 0.8)	0.6 (0.5, 0.8)	<0.001	77.4	75.6	0.9 (0.6, 1.3)	0.9 (0.6, 1.3)	0.5
Gender attitudes:											
Marriage:											
Girls should have a say in who they marry	Somewhat agree/agree	95.0	95.0	1.0 (0.6, 1.6)	0.9 (0.5, 1.5)	0.7	94.9	96.0	1.3 (0.6, 2.9)	1.3 (0.6, 3.0)	0.5
A wife should always obey her husband	Somewhat agree/agree	60.1	80.7	2.8 (2.1, 3.6)	2.8 (2.1, 3.6)	<0.001	63.0	85.8	3.6 (2.3, 5.7)	3.5 (2.3, 5.5)	<0.001
It's OK for a husband to beat his wife if she has done something wrong	Somewhat agree/agree	63.4	74.1	1.6 (1.3, 2.1)	1.6 (1.3, 2.1)	<0.001	65.4	72.0	1.4 (1.0, 1.9)	1.3 (0.9, 1.8)	0.2
Education											
Daughters should be sent to school only if they're not needed to help at home	Somewhat agree/agree	11.3	22.8	2.3 (1.8, 3.1)	2.5 (1.8, 3.3)	<0.001	13.8	17.6	1.3 (0.9, 2.0)	1.3 (0.9, 2.0)	0.2
Educated girls become rebellious and don't make good wives	Somewhat agree/agree	26.1	36.3	1.6 (1.3, 2.0)	1.6 (1.3, 2.0)	<0.001	28.1	33.3	1.3 (0.9, 1.8)	1.3 (0.9, 1.8)	0.1
If there is limited money to pay for tutoring, it should be spent first on sons	Somewhat agree/agree	20.2	32.3	1.9 (1.5, 2.4)	1.9 (1.5, 2.5)	<0.001	5.9	5.7	1.1 (0.8, 1.6)	1.1 (0.8, 1.6)	0.5
It is equally important to encourage daughters to get an education as it is with sons	Somewhat agree/agree	98.4	98.4	1.0 (0.4, 2.4)	1.0 (0.4, 2.5)	0.9	98.3	99.4	3.0 (0.4, 22.6)	3.1 (0.4, 23.2)	0.3
Teasing:											
Girls who are harassed or teased encourage it by the way they act or dress	Somewhat agree/agree	28.8	26.8	0.9 (0.7, 1.1)	0.9 (0.7, 1.2)	0.4	28.1	30.3	1.1 (0.8, 1.6)	1.2 (0.8, 1.7)	0.4
Mobility:											
Girls should have the same rights and freedoms as boys	Somewhat agree/agree	98.8	97.3	0.5 (0.2, 1.0)	0.5 (0.2, 1.3)	0.2	98.4	98.3	1.0 (0.3, 3.3)	1.0(0.3, 3.6)	1
Once a girl attains puberty, she shouldn't be allowed to roam free in the village	Somewhat agree/agree	41.8	63.6	2.5 (2.0, 3.2)	2.6 (2.1, 3.3)	<0.001	46.0	59.1	1.7 (1.2, 2.3)	1.6 (1.1, 2.2)	0.005
Eve teasing:											
Sexually teased or harassed past 3 mo or past 12mo	Yes	12.9	8.5	0.6 (0.4, 0.9)	0.6 (0.4, 0.9)	0.007	12.1	9.2	0.7 (0.4, 1.3)	0.7 (0.4, 1.3)	0.3

		In school (n=1338)	Drop school (n=450)	Unadjusted Odds Ratio*	Adjusted Odds Ratio†		Unmarried (n=1612)	Married (n=176)	Unadjusted Odds Ratio*	Adjusted Odds Ratio†	
School environment:											
Harassing/bullying school environment	Yes	3.8	6.0	1.7 (1.0, 2.7)	1.6 (0.9, 2.6)	0.09	4.6	2.3	0.5 (0.2, 1.4)	0.5 (0.2, 1.4)	0.17
Harsh physical punishment by teachers	Yes	4.6	9.3	2.1 (1.4, 3.2)	2.0 (1.3, 3.2)	0.002	5.6	6.8	1.2 (0.6, 2.2)	1.2 (0.6, 2.2)	0.7
Empowerment:											
Self-efficacy scale	Medium/ High	80.3	45.6	0.2 (0.2, 0.3)	0.2 (0.2, 0.3)	<0.001	74.1	50.9	0.4 (0.3, 0.5)	0.4 (0.3, 0.5)	<0.001
Activism scale	Medium/ High	76.3	46.0	0.3 (0.2, 0.3)	0.2 (0.2, 0.3)	<0.001	71.0	47.9	0.4 (0.3, 0.5)	0.4 (0.3, 0.6)	<0.001
I do not have hope for my future	Somewhat agree/agree	11.2	24.4	2.6 (1.9, 3.4)	3.1 (2.3, 4.2)	<0.001	13.3	26.1	2.4 (1.6, 3.5)	2.3 (1.6, 3.5)	<0.001

*Models were adjusted for stratum.

†Models were adjusted for trial arm, district, study cohort, stratum, as well as for caste, orphanhood and literacy status of the household head.

DISCUSSION

In this study of SC/ST adolescent girls living in two rural, northern Karnataka district, we found that girls in the intervention arm were significantly more likely to have increased uptake of skills and training, increased participation in extra-curricular activities (some of which were delivered by the programme), and to report more gender equitable attitudes around marriage compared with girls in the control arm, but there was no real difference in uptake of education scholarships, school environment, or gender equitable attitudes around education, eve teasing or girl's mobility. Thus, the programme had an impact on some but not all of the factors it aimed to change on the hypothesised pathway to education retention and delayed age at marriage. In addition, girls who were in school or unmarried at endline had more gender equitable attitudes, improved social network and increased uptake of skills and training compared with girls who had dropped out of school or were married. They were also more likely to have higher levels of self-efficacy and activism, and more likely to report having hope for the future. This suggests that all of the factors hypothesised to be on the pathway to education retention and delayed age at marriage were indeed associated with education retention, and several were associated with delayed age at marriage among girls, at endline.

Despite impacting on several factors hypothesised to be on the pathway to child marriage and secondary school drop-out, we did not find an overall impact of *Samata* on these two outcomes. Levels of child marriage (10%) were far lower than we had estimated at the start of the trial (25%), based on regional level data available at that time.[8] Our recent analysis of nationally representative datasets at the district, state and national level suggests India has been undergoing substantial changes in marriage and education patterns, with steadily declining levels of child marriage and increasing levels of lower secondary school completion over the past 15 years.[16] The introduction of legislation outlawing child marriage and national level campaigns and policies may have contributed to these reductions. Our qualitative research suggests that it is usually parents and extended family members who are the ultimate decision makers around marriage, and that such arrangements may have been made long before our intervention began (anytime from birth). Thus, increasing girl's sense of agency and providing additional skills and training, was likely insufficient to impact on families' decisions to marry their daughters; focusing the intervention efforts on changing family and community level attitudes and norms may have had more impact.

The global literature and data from our previous analyses suggests that a variety of factors may influence whether a girl in impoverished rural communities enters into and completes her secondary education, or not.[1,17,18] These include her academic attainment; her desire to stay in education; poverty and the economic need for (girl) labour at home; and community norms around family honour and the visible preservation of a girl's 'sexual purity' once she reaches menarche in order to ensure her future marriageability (leading to withdrawal from school once menses start).[17,19] Our findings here suggest that while the intervention did impact on girl's uptake of skills and training, and participation in extra-curricular activities (some of which were provided by the intervention), there was no programme impact on girl's access to financial schemes offered by the government to support continuation of SC/S girls in secondary education, with most in-school girls accessing scholarships. The non-differential uptake of government scholarships likely reflects efforts by government to ensure eligible families are aware of and supported to uptake these economic incentives. Elsewhere, cash transfers or other economic incentives to support girls to stay in secondary school have been effective in increasing education retention rates.[20–22] We did not include this as part of our intervention design as we wanted our intervention to be as sustainable as possible at trial end, and the India government has a benefits system to support those most in need. Similar to child marriage, levels of secondary school dropout at trial endline (25%) were far lower than we anticipated at trial start (30-40%), again following patterns of secular trends seen at the district, state and national level.[8,16]

Factors hypothesised by the team at the study start to be on the pathway to education retention and/or delayed age at marriage were indeed associated with these outcomes at end-line, supporting these original hypotheses. In addition, our findings suggest a clustering of disadvantage among girls in these marginalised communities, with girls who have withdrawn from secondary school or married before age 18 less likely to have accessed skills or training, to have participated in extra-curricular activities, to have gender equitable attitudes, or to have made new friends in the past 12 months. They are also likely to have lower self-efficacy and 'activism'. Studies elsewhere find that reduced social interactions or loneliness can lead to psychological distress[23] and we also report here that girls who are out of school or married were twice as likely to report not having hope for the future, compared with girls in-school or unmarried. The underlying community-level norm around preserving a girl's sexual purity until marriage, which indirectly leads to early marriage and withdrawal from girls from school, was only identified part-way through our intervention,[17] and subsequent efforts to address this with families were likely too late. Thus, this wasn't included on our Theory of Change or our evaluation questions, but was likely important.

"Eve-teasing" or harassment of girls by boys and men is a phenomenon commonly reported in the Indian literature and media, although it is unclear how physically dangerous this is in practice. In a setting such as this one, where social interactions between adolescent boys and girls are all but banned, "eve teasing" (whistling, throwing small stones, passing notes) may be a way for boys to communicate with girls that they like. However, being seen to be teased can have serious social consequences for a girl and her family, impacting on her perceived 'honour', 'purity' and subsequent marriage prospects. As such, the fear of a girl being teased can frequently lead to her - and other girls in her village - being withdrawn from education and married young. *Samata* aimed to address harassment of girls in the village and on their way to school by implementing sports-based Parivartan groups with boys at the village level, which included sessions on challenging harmful gendered practices. Our findings here suggest that the intervention was associated with a slight but significant increase in eve teasing among girls in the intervention compared with girls in the control villages. This could be true, suggesting the Parivartan sessions for boys either did not work or did not reach the most desirable boys. Alternatively, it could be that awareness raising about eve teasing by the programme resulted in increased recognition and reporting by girls in the intervention arm at end line.

Samata aimed to make the school environment more enabling for girls, through different activities including

teacher training, development of safety plans for girls and the implementation of tracking tools within schools to track absent pupils and conduct outreach with them. Although our analysis here did not evaluate differences in these outcomes at the school-level, we did examine the impact of the intervention on girl's perceptions of their school environment. We found that the proportion of girl's reporting a poor school environment – one where they felt harassed, bullied, or physically threatened by staff or pupils – was relatively low (<7%), but was higher among girl's who were dropped-from compared with in- school. In addition, there was no impact of the intervention on these outcomes (from the girl's perspective). During our trial period, the state government adopted and implemented many of the school level components the *Samata* intervention had designed. Whilst this will clearly benefit girls across the state, it does make comparisons of school-level intervention exposure in the intervention vs. 'control' villages difficult. In addition, the global literature recognises that as education retention rates are improving, there is a need to shift the focus to also improving the *quality* of education children receive.[24]

STRENGTHS AND LIMITATIONS

Our results should be generalizable to rural SC/ST girls in India. We included all SC/ST girls enrolled in 7th standard in our sample, had a large number of clusters, 100% of selected villages agreed to participate and no villages dropped out of the study. Analysis of baseline balance suggested the randomisation process worked well and the study design was robust. Our trial outcomes were reliant on self-reported measures and were likely to be subject to reporting bias. This likely resulted in under-reporting in sensitive variables such as child marriage, eve teasing, bullying/harassing school environment and over-reporting in others such as gender equitable attitudes and secondary school completion. Measuring gender equitable attitudes is a novel and expanding field; the variables we included worked best when they were specific about a circumstance. Finally, policy/government-level factors included in our Theory of Change were not measured in our study. However, the uptake and implementation of key parts of our school-level interventions by the government during and following our trial suggest we were able to influence programming regarding tracking and supporting girls to stay in school.

CONCLUSIONS

Taken together, this study suggests that *Samata* did have an impact on some, but not all, factors to be hypothesised on the pathway to education retention and child marriage, but that this was not sufficient to change the overall trial outcomes. Substantial secular changes occurring across India regarding age at marriage and years of schooling will benefit girls and boys now, as well as their future children. Targeted interventions, which are sensitive to the economic realities and community-level norms of these marginalised communities (so as not to further stigmatise families), are needed to ensure that "no-girl is left behind". This will also help address the clustered deprivations and outcomes that married, less-educated girls living in these rural, SC/ST communities continue to experience. Learnings from our study can be used to inform future interventions which similarly aim to impact on child marriage and secondary school retention within programmatic timeframes.

Acknowledgements: The study team would like to thank the study participants, including adolescent girls, families, school staff and village communities, as well as the programme implementation team for their tireless work throughout the study. We thank the local and state government for their support of the programme. We would also like to acknowledge Mr Raj Kumar at KHPT for superb data management and support, and the LSHTM Centre for Evaluation for statistical support and advice, in particular Profs Richard Hayes, Helen Weiss and James Hargreaves, and Dr James Lewis.

Funding: *Samata* was funded by the UK Department for International Development (DFID) as part of STRIVE, an 8-year programme of research and action devoted to tackling the structural drivers of HIV (http://STRIVE.lshtm.ac.uk/) and Viiv Healthcare. The views expressed herein are those of the authors and do not necessarily reflect the official policy or position of the UK government or Viiv Healthcare. None of the funding sources played a role in the design of the study, data collection, analysis, interpretation, or writing of the results. The corresponding authors had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Authorship contributions: TSB and RP designed the analysis and wrote the first draft of the manuscript. TSB performed the analyses. RP, PJ, MC, MG, PB supported the analyses. TSB, RP, PJ, MC, CW, SI, MG and PB contributed to the conceptualization of the analysis and reviewed the data analysis plan. All authors contributed to the study design, interpretation of the results, and reviewed the manuscript.

Competing interests: The authors completed the Unified Competing Interest form at www.icmje.org/coi_disclosure.pdf (available upon request from the corresponding author), and declare no conflicts of interest.

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SUPPLEMENTARY MATERIALS

Online Supplementary Document

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