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A psychosocial resilience curriculum provides the “missing piece” to boost adolescent physical health: A randomized controlled trial of Girls First in India



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ABSTRACT

Rationale and objectives: Despite a recent proliferation of interventions to improve health, education, and livelihoods for girls in low and middle income countries, psychosocial wellbeing has been neglected. This oversight is particularly problematic as attending to psychosocial development may be important not only for psychosocial but also physical wellbeing. This study examines the physical health effects of Girls First, a combined psychosocial (Girls First Resilience Curriculum [RC]) and adolescent physical health (Girls First Health Curriculum [HC]) intervention (RC + HC) versus its individual components (i.e., RC, HC) and a control group. We expected Girls First to improve physical health versus HC and controls.

Methods: Over 3000 girls in 76 government middle schools in rural Bihar, India participated. Interventions were delivered through in-school peer-support groups, facilitated by pairs of local women. Girls were assessed before and after program participation on two primary outcomes (health knowledge and gender equality attitudes) and nine secondary outcomes (clean water behaviors, hand washing, menstrual hygiene, health communication, ability to get to a doctor when needed, substance use, nutrition, safety, vitality and functioning). Analyses included Difference-in-Difference Ordinary Least-Squares Regressions and *F*-tests for equality among conditions.

Results: Girls First significantly improved both primary and eight secondary outcomes (all except nutrition) versus controls. Additionally, Girls First demonstrated significantly greater effects, improving both primary and six secondary outcomes (clean water behaviors, hand washing, health communication, ability to get to a doctor, nutrition, safety) versus HC.

Conclusions: This study is among the first to assess the impact of a combined psychosocial and adolescent health program on physical health. We found that combining these curricula amplified effects achieved by either curriculum alone. These findings suggest that psychosocial wellbeing should receive much broader attention, not only from those interested in improving psychosocial outcomes but also from those interested in improving physical health outcomes.

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1. Introduction

Six hundred million adolescent girls live in low and middle income countries (LMICs) today (Greene et al., 2010). Though strong in number, these girls are significantly less likely than their male counterparts to be educated, employed, and physically healthy (International NGO Council on Violence Against Children, 2013; Mathur et al., 2003; Rafferty, 2013).

Gender inequality among LMIC youth has recently become a hot

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topic among governments, non-governmental and intergovernmental organizations. For instance, agencies such as the World Health Organization, the World Bank, the United Nations Population Fund, UNICEF, the Clinton Global Initiative, and the Nike Foundation have all adopted policies and promoted campaigns based on investing in adolescent girls. These agencies represent only a few in a growing trend: many LMIC governments, nonprofit organizations, and foundations have followed suit (see Levine et al., 2008 for relevant examples).

Attention to gender inequality in LMICs has often focused on girls' physical health, education, and livelihoods. While these elements are certainly essential to improving girls' wellbeing, a critical component has been consistently overlooked: psychosocial development. Though some groups mentioned above, including the World Health Organization, have publicly called for interventions integrating psychosocial services in efforts to improve girls' wellbeing, psychosocial interventions remain scarce in practice, particularly in LMICs (Prince et al., 2007).

The importance and urgency of focusing on psychosocial wellbeing for adolescent girls in LMICs is twofold. First, adolescent girls worldwide are more vulnerable than boys to many mental health problems, particularly to internalizing problems such as depression and anxiety (e.g., Kessler, 2003; Lewinsohn et al., 1998; Nolen-Hoeksema, 2001; World Health Organization, 2002). Ignoring psychosocial wellbeing in girls' services therefore amounts to letting a critical component of gender inequality go unchecked.

The second reason psychosocial wellbeing among adolescent girls in LMICs is so important is that evidence suggests a close relationship among psychosocial wellbeing and other high-priority aspects of wellbeing, particularly physical health. For instance, problems such as depression have been shown to be linked to physical health concerns such as incidence of STIs (Erbelding et al., 2004; Ramrakha et al., 2000), early sexual debut, risky sexual behaviors (Ramrakha et al., 2000), and sleep problems (Patten et al., 2000). Limited evidence from higher income countries suggests that some psychosocial interventions can have a beneficial effect on physical health (e.g., Astin et al., 2003; Grossman et al., 2004; Nelis et al., 2011).

It is therefore possible that integrating interventions to improve psychosocial wellbeing with interventions to improve physical health could amplify the improvement of physical health among girls in LMICs. If this is the case, psychosocial interventions may represent a critical missing piece in international development efforts to improve the physical health of girls.

Some organizations in LMICs have given limited attention to psychosocial wellbeing as a component of physical health programs (such programs are often referred to as Life Skills Based Health Education; UNICEF, 2012). However, there is a lack of adequately-controlled trials aimed at determining whether including a substantial focus on psychosocial wellbeing in interventions designed to promote physical health in adolescents elicits physical health benefits.

1.1. The case of India

India represents an important case to study these dynamics as 20% of the world's adolescent girl population is in India (Dasra & The Kiawah Trust, 2012). Girls in India tend to face early marriage and early pregnancy, have a high likelihood of domestic violence, and are unlikely to receive as much education as their male peers, resulting in poor sexual and reproductive health (Dasra & The Kiawah Trust, 2012; Nanda et al., 2013; Paul et al., 2011).

Although many programs in India have begun to focus on adolescent girls, most interventions focus on their physical health, livelihoods or education alone. There has been a proliferation of

programs focused on sexual and reproductive health, many with goals to improve health knowledge and gender equality attitudes (Nanda et al., 2013). However, this approach is one-dimensional, as few programs have addressed or explored potential relationships among any of these areas – physical, educational, livelihood, or psychosocial – through a combined program. Most programs for India's girls have focused on a single area of need and have not taken advantage of the potential for comprehensive programs to amplify and accelerate improvements across many outcomes at once (Nanda et al., 2013). A focus on psychosocial wellbeing could be added to girls' programs, not only for improvements in psychosocial wellbeing but to enhance other outcomes that are addressed in comprehensive programs.

In part, this lack of comprehensive programs may stem from the paucity of research quantifying the effects of programs focused on multiple areas of need versus programs focused on a single area of need. To our knowledge, there is no empirical evidence in any LMIC that a program combining a focus on psychosocial wellbeing with a focus on physical health results in greater physical health improvements than a program focused solely on physical health.

1.2. Study objectives

The major goal of this analysis is to quantify the physical health effects of combining two curricula: the Girls First Resilience Curriculum (RC), which targets psychosocial wellbeing, and the Girls First Health Curriculum (HC), which targets physical health and wellbeing, versus the components alone and a school-as-usual control group (SC), among adolescent girls in a high-poverty, LMIC setting (rural Bihar, India).

In this paper, we test the main hypothesis that the Girls First program (RC + HC) will improve physical health and wellbeing compared to SC. We also test the secondary hypothesis that RC + HC will improve physical health and wellbeing to a greater extent than HC alone. Finally, we report additional exploratory analyses that test differences between all pairs of conditions.

2. Methods

The analyses reported here use data from *Girls First – Bihar*, which was a randomized controlled trial conducted by CorStone, a 501(c)3 non-profit based in the US, including the four study conditions described above. *Girls First – Bihar* was designed to quantify effects of each condition on emotional, social, physical, and educational wellbeing, among over 3000 girls in VII–VIII Standards (equivalent to 7th and 8th grades in the US) in 76 government schools in rural Bihar, India. This paper focuses on intervention effects on physical health and wellbeing outcomes only, immediately before and after each program for all four conditions. Other analyses, reported elsewhere, have detailed program effects on emotional and social outcomes (Leventhal et al., 2015b). This study began in 2013 and was overseen by two Institutional Review Boards (IRBs), Sangath IRB in Goa, India, and Chesapeake IRB in Maryland, US.

The methods for *Girls First – Bihar* have been described elsewhere in detail (Leventhal et al., 2015a). Here we briefly summarize methods relevant to the analysis presented in this paper.

2.1. Study settings

We selected Bihar, India as the study location because it has one of India's highest poverty levels (Oxford Poverty and Human Development Initiative, 2014) and girls remain highly marginalized. For instance, 64% of Bihar's girls are married before 18 years of age, and 45% of Bihar's girls and women aged 15–49 years have

experienced physical or sexual violence (Dasra & The Kiawah Trust, 2012). All aspects of the study, including the consent process (i.e., parental consent and child assent), assessments, and interventions were conducted in Hindi in Bihar's government middle schools.

2.2. Participants, sampling and randomization

CorStone first selected two local non-profits (Gramin Evam Nagar Vikas Parishad and Integrated Development Foundation) with a strong community presence, in the city of Patna, Bihar, with the capacity to be trained to conduct the interventions. These organizations selected three rural blocks (a block is an administrative sub-division of a district) for the study: Phulwarisharif, Maner, and Bihta. At their recommendation, we considered Maner as two distinct geographies, as there is a clear divide between a higher socio-economic status and less flood-prone portion (simply called Maner) and a lower socio-economic status and more flood-prone portion (Maner Diyara); thus, throughout this paper we refer to four geographic areas rather than three.

The initial study frame included 97 schools in which these partners deemed it possible to work based on accessibility and previous relationships. To approximate the small school settings typical of rural India (Jacob et al., 2008), schools with a maximum of 150 girls enrolled in VII–VIII Standards were selected from the initial study frame. Of these, we selected schools with enough girls to form at least one intervention group (a minimum of 20 girls was required for one group of 12–15 students, considering potential for drop-outs and attendance issues). Seventy-six schools were randomly allocated to study conditions (19 per condition) using blocked randomization, and were stratified by geographic location and size. After randomization, no significant differences were found among conditions on location or school size at the school level.

2.3. Interventions

Two interventions were tested that together made up Girls First: RC and HC. Both interventions used a facilitated peer-support pedagogy that included case studies, small group activities, and group discussion. The topics covered in each program are summarized in Table 1 (more information about each intervention can also be found in Leventhal et al., 2015a). In SC, girls received no

intervention beyond attending their middle school academic classes as they normally would.

RC consisted of 23 weekly sessions designed to improve girls' psychosocial resilience, or their ability to bounce back from challenges. The program drew from fields such as positive psychology (e.g., Seligman and Csikszentmihalyi, 2000), emotional competence or intelligence (e.g., Goleman, 2006), restorative practices (e.g., International Institute for Restorative Practices, 2009; McCluskey et al., 2008), and peer support (e.g., Ellis et al., 2009). Characterizing intervention content in terms of Michie et al.'s (2013) taxonomy of behavior change techniques, RC includes a strong focus on goals and planning (grouping 1), social support (grouping 3), and identity (grouping 13). Other analyses from *Girls First – Bihar* (reported elsewhere) have shown that RC improves emotional resilience, self-efficacy, social-emotional assets, psychological wellbeing, and social wellbeing compared to SC (Leventhal et al., 2015b).

HC consisted of 21 weekly sessions to improve girls' knowledge of, attitudes about, and behaviors related to physical health issues. The training provided in-depth discussion and activities about topics such as sexual and reproductive health, common diseases, nutrition, gender equality, and substance use. Much of HC was adapted from a training called Adolescents Gaining Ground (Society for Nutrition, Education and Health Action; SNEHA Mumbai, 2013). According to Michie et al.'s taxonomy (2013), HC's content included a strong focus on shaping knowledge (grouping 4) and natural consequences (grouping 5).

Facilitators were recruited from local communities with the following requirements: they had to be women, aged 18 years or older, with at least a Standard X education (equivalent to US 10th grade). Facilitators conducted the interventions in pairs with approximately 12–15 girls in each group. Facilitators were supervised, trained, and supported by Master Trainers with a Master's level degree in psychology, social work, or a similar discipline. Out of 74 facilitators, 59 were un-shared across conditions (80%). Thirteen were shared between RC + HC and RC, one between RC and HC, and one among all three conditions.

Facilitators followed a manual and Master Trainers conducted facilitator performance ratings during monitoring visits on a monthly basis for intervention standardization and quality assurance. Ratings indicated that facilitator performance was generally adequate or more than adequate. For instance, during 89% of

Table 1
Intervention sessions.

Session	Resilience Curriculum (RC) Sessions Session topics	Session	Health Curriculum (HC) Sessions Session topics
1	Introduction and assessments	1	Introduction and assessments
2	Setting group guidelines	2	The health system
3	Listening skills	3–4	Nutrition and anemia
4–5	Character strengths	5	Water, sanitation and health
6	Life stories and goals	6	Key health issues
7	Planning to reach our goals	7	Diarrhea and diarrhea management
8	Identifying emotions	8	Review
9	Emotional awareness	9–10	Gender constructs
10–12	Managing strong emotions and benefit finding	11	Know your body
13	Assertive communication	12	The reproductive system
14	Restorative practices for conflict resolution	13	Menstruation and hygiene
15	Group problem solving	14	My relationships
16	Identifying and opposing violence	15	Intimate relationships
17	Forgiveness and apologies	16	Physical intimacy
18	Self-esteem and character strengths	17	Gender-based violence
19	Problem solving with a focus on friendships	18	Understanding and promoting rights
20–21	Peace project	19	Substance use and abuse
22	Review and celebrate	20	Review and celebrate
23	Assessments and gratitude	21	Assessments

observed HC and 85% of RC sessions, facilitators followed session structure adequately or better; and during 80% of observed HC and 87% of RC sessions, facilitators were able to cover all session content adequately or better. Any facilitators who performed inadequately were provided additional support and mentorship from Master Trainers.

2.4. Overview of the current study

There were four study conditions: (1) RC only, (2) HC only, (3) RC + HC, and (4) SC. During the full *Girls First – Bihar* trial, girls in all study conditions filled out questionnaires measuring a range of emotional, social, physical, and educational outcomes at four time points, each separated by approximately four to five months.

The current study analyzes the time points directly before (Time 1 [T1] for all conditions), and after the girls completed their respective interventions (Time 2 [T2] is used for girls in RC and HC only, and Time 3 [T3] for girls in RC + HC). T2 is used for the comparison between SC to RC or HC only, and T3 is used to compare SC to RC + HC. Fig. 1 depicts the study flow, including the timing of the interventions and assessments relevant to this analysis.

2.5. Measures

Participants completed questionnaires of approximately 90 minutes to two hours at each time point. Questionnaires included standard measures of physical health used by other researchers in similar populations, as well as questions developed or adapted specifically for this study. The questionnaire underwent extensive piloting to ensure that it was appropriate and valid in this population (detailed elsewhere; Leventhal et al., 2015a).

We measured a range of physical health outcomes, all of which were self-reported due to resource and logistical constraints. We include physical health-related knowledge, attitudes, behaviors, and wellbeing as target outcomes. Knowledge and attitudes are considered primary outcomes as they are directly targeted by HC and are precursors to changes in health-related behaviors and wellbeing. These behavior and wellbeing changes are considered secondary outcomes. Additional information about the study measures is provided in an online supplement (see Appendix A).

2.5.1. Primary outcomes: health knowledge and attitudes

We include two measures as primary outcomes: health knowledge and gender equality attitudes. These outcomes were chosen in part because they have often been targeted previously to improve physical health for youth (e.g., Dworkin et al., 2011; Paul-Ebhohimhen et al., 2008; Pulerwitz et al., 2010). Although gender equality attitudes have significant crossover with psychosocial wellbeing, we consider this to be an indicator of physical health and wellbeing. These attitudes are often targeted during interventions focused on reproductive and sexual health for adolescents in LMICs as they are closely linked to improvements in health behaviors and outcomes, particularly for girls and women (Cohen and Burger, 2000; Dworkin et al., 2011).

Additionally, health knowledge and attitudes were chosen as outcomes because they are widely recognized as integral elements in efforts to ultimately change health behaviors and wellbeing in various theoretical frameworks. The knowledge, attitudes and behaviors model (Schrader and Lawless, 2004), as well as social cognitive theory (Bandura, 1986, 1998; Committee on Communication for Behavior Change in the 21st Century, 2002), recognize the role of health knowledge and attitudes as basic steps along the path to ultimately effectuating change in health behaviors and wellbeing. Thus, in order to detect effects from the intervention, changes in knowledge and attitudes should be the focus (and

be the clearest), while changes in behaviors and wellbeing may be more distal.

2.5.2. Secondary outcomes: behaviors and wellbeing

We include a range of measures assessing health-related behaviors and wellbeing: clean water behaviors, hand washing, menstrual hygiene, communication with adults about health issues, ability to get to a doctor or clinic when needed, substance use, nutrition, safety, and physical vitality and functioning.

In addition to being considered more distal outcomes in health behavior change efforts than knowledge and attitudes (e.g., Fishbein and Yzer, 2003), health behaviors are potentially more difficult to change than knowledge and attitudes, particularly in LMICs (e.g., Paul-Ebhohimhen et al., 2008). We therefore expected that our hypotheses would hold for all primary outcomes and that we would begin to see indications of change for secondary outcomes as well.

2.5.3. Covariates

We include a range of socio-demographic and health-related variables as covariates: age, home density, education levels of the father and mother, assets possessed by the family, whether the girl's school had been affected by monsoon flooding during the intervention, the student-teacher ratio at her school, and whether the girl had ever received a vaccine. These covariates and their measurement are detailed further in online supplemental file Appendix A.

2.6. Sample size

We calculated desired sample size using Generalized Estimating Equations and effect sizes and variances from pilots of RC (Andrew, 2010; Leventhal and Sachs, 2011). Based on these calculations, we found that 19 schools per condition with 40 students per school would be more than adequate.

2.7. Statistical methods

We tested our hypotheses using Difference in Difference (DID) Ordinary Least-Squares Regression estimations and *F*-tests for equality. We first conducted DID regressions for all outcome variables without including any covariates. We then added all of the covariates to the models and re-ran DID regression analyses. By examining R^2 values, we chose the models that explained the greatest amount of variance (i.e., the best-fit models) for further analysis.

We examined the magnitude, direction, and significance of the effects from the best-fit models for each of the outcomes to evaluate the effectiveness of each intervention versus SC. Next, we examined the magnitude and direction of the coefficients for intervention \times time interactions, which, combined with *F*-tests for equality, allowed us to compare the effects of each intervention against another. Bonferroni corrections were made to account for testing two primary outcomes, and findings were interpreted to be significant when $p \leq 0.025$.

All analyses were intent-to-treat, meaning that all girls randomized into a study condition were analyzed as part of that condition, regardless of intervention attendance.

3. Results

3.1. Participant flow and attrition

Fig. 1 depicts the flow diagram of the study. Of the 3633 girls invited to participate in the study, 3560 (98%) completed the

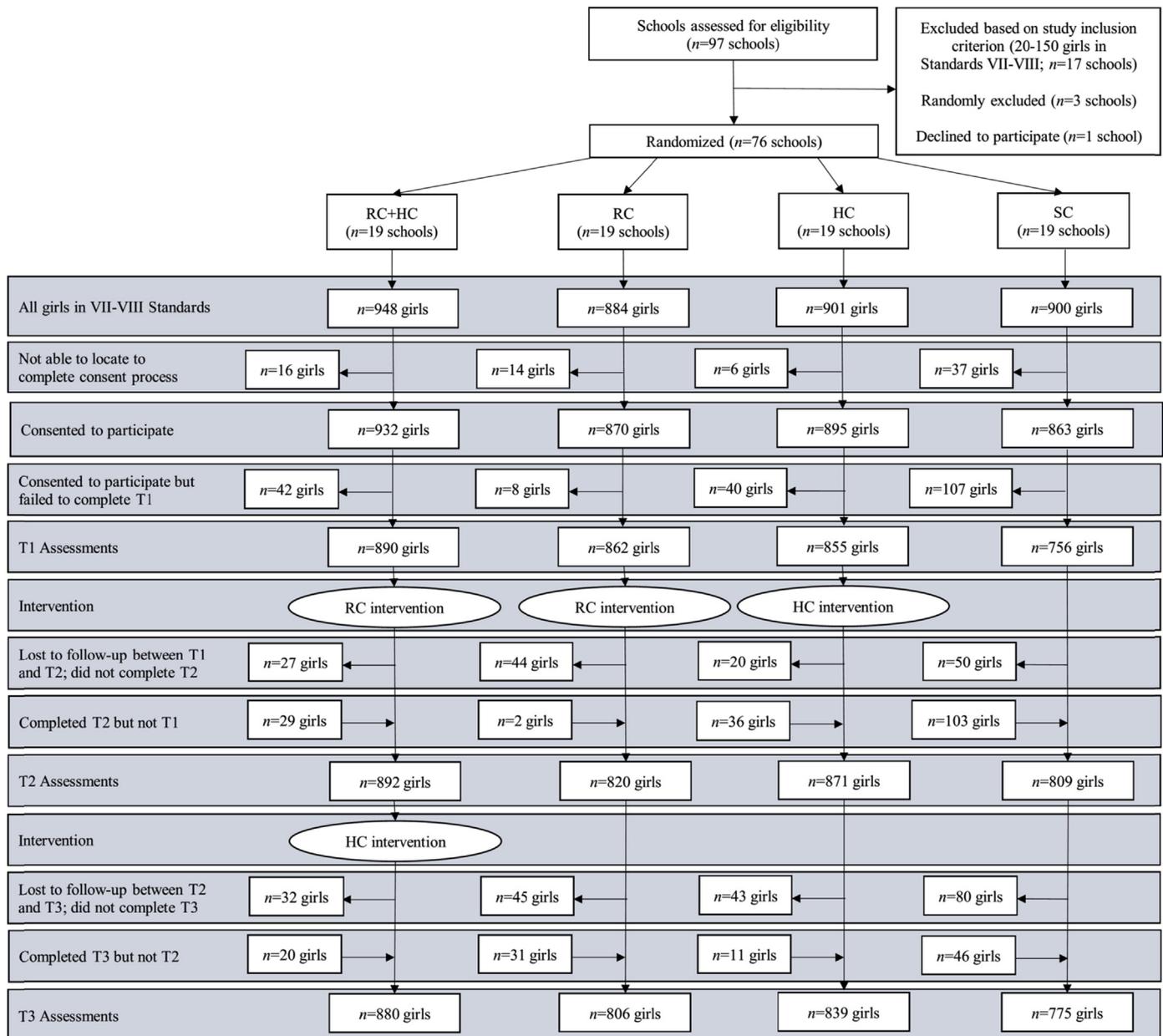


Fig. 1. CONSORT diagram detailing study flow of all relevant time points and conditions in this analysis. T1 = Time 1; T2 = Time 2; T3 = Time 3; RC = Resilience Curriculum; HC = Health Curriculum.

consent process. The assessment process also faced very low attrition levels: T1 included 3363 of the 3560 girls who consented to participate (95%), T2 included 3392 (95%), and T3 included 3300 (93%).

Girls lost to follow-up by the end of their programs differed on a number of covariates and outcomes as measured at T1. (We consider HC and RC girls lost to follow-up if they were present for T1 but not T2, and RC + HC and SC girls lost to follow-up if they were present for T1 but not T3.) Girls lost to follow-up were less likely to be from Phulwarisharif or Maner Diyara and more likely to be from Maner or Bihta ($p < 0.004$), less likely to be vaccinated ($p = 0.021$), and attended schools with lower student-teacher ratios ($p = 0.024$) compared to girls who completed the intervention. Girls lost to follow-up were also less likely to practice clean water behaviors ($p = 0.034$), but more likely to have better menstrual hygiene ($p < 0.001$) and better health knowledge ($p = 0.010$) than

girls not lost to follow-up. All other differences were non-significant.

We found three instances of differential attrition across conditions. First, girls lost to follow-up in RC + HC, RC and SC were less likely to be able to get to a doctor when needed than girls lost to follow-up in HC ($p \leq 0.004$). Girls lost to follow-up in RC + HC, HC and SC attended schools with lower student-teacher ratios than girls lost to follow-up in RC ($p \leq 0.005$). Finally, girls lost to follow-up in HC and RC were less likely to be from flooded schools than girls in SC ($p \leq 0.022$).

3.2. Time 1: covariates and outcomes

Table 2 provides T1 scores on covariates and outcomes, including girls' demographic characteristics. At T1, girls in the full sample were an average of 12.97 years old ($SD = 1.20$). They

Table 2
Time 1 scores on covariates and outcomes, analysis of variance among conditions, and post-hoc difference tests.

Study variables ^a	Scores for the total sample and intervention conditions					ANOVA <i>P</i> -value
	Full sample	RC + HC	HC	RC	SC	
<i>Covariates</i>						
Age (years)	12.97 (1.2) 3320	13.02 ^a (1.25) 878	12.95 ^a (1.14) 849	12.96 ^a (1.21) 856	12.94 ^a (1.18) 737	0.512
Father's education	1.62 (0.75) 2979	1.52 ^a (0.82) 788	1.65 ^b (0.73) 777	1.66 ^b (0.73) 758	1.67 ^b (0.7) 656	<0.001
Mother's education	1.04 (0.96) 2860	1.04 ^a (0.96) 757	1.07 ^a (0.96) 734	1.02 ^a (0.97) 744	1.02 ^a (0.96) 625	0.716
Assets	4.84 (1.84) 3341	4.86 ^a (1.81) 883	4.63 ^b (1.87) 853	4.95 ^a (1.82) 860	4.94 ^a (1.85) 745	0.001
Home density	2.65 (1.98) 3183	2.49 ^a (1.75) 828	2.66 ^{a,b} (2.05) 798	2.71 ^b (2.11) 839	2.77 ^b (1.96) 718	0.034
Vaccinated	0.88 (0.32) 2879	0.86 ^a (0.35) 722	0.94 ^b (0.24) 739	0.85 ^a (0.36) 758	0.90 ^c (0.30) 660	<0.001
School flooded	0.17 (0.53) 3363	0.12 ^a (0.48) 890	0.04 ^b (0.21) 855	0.2 ^c (0.6) 862	0.32 ^d (0.69) 756	<0.001
Student teacher ratio	65.07 (30.28) 3363	59.37 ^a (19.93) 890	74.05 ^b (40.73) 855	74.23 ^b (29.07) 862	51.17 ^c (18.92) 756	<0.001
Phulwarisharif	0.40 (0.49) 3363	0.43 ^a (0.50) 890	0.41 ^a (0.49) 855	0.39 ^a (0.49) 862	0.40 ^a (0.49) 756	0.422
Maner	0.38 (0.49) 3363	0.41 ^a (0.49) 890	0.40 ^a (0.49) 855	0.33 ^b (0.47) 862	0.38 ^a (0.49) 756	0.001
Bihta	0.15 (0.36) 3363	0.14 ^a (0.34) 890	0.14 ^a (0.35) 855	0.19 ^b (0.39) 862	0.14 ^a (0.34) 756	0.010
Maner Diyara	0.06 (0.24) 3363	0.03 ^a (0.16) 890	0.04 ^b (0.21) 855	0.10 ^c (0.30) 862	0.09 ^c (0.28) 756	<0.001
<i>Primary outcomes</i>						
Health knowledge	4.13 (2.34) 3195	3.85 ^a (2.12) 847	4.49 ^b (2.06) 825	4.22 ^c (2.59) 828	3.92 ^a (2.51) 695	<0.001
Gender equality attitudes	22.98 (6.53) 3194	21.96 ^a (6.19) 854	24.33 ^b (6.67) 831	22.8 ^c (6.9) 811	22.8 ^c (6.04) 698	<0.001
<i>Secondary outcomes</i>						
Clean water behaviors	0.72 (0.74) 3256	0.64 ^a (0.76) 839	0.86 ^b (0.8) 837	0.69 ^a (0.66) 849	0.69 ^a (0.71) 731	<0.001
Hand washing	9.39 (1.44) 3074	9.25 ^a (1.53) 790	9.57 ^b (1.21) 784	9.3 ^{a,c} (1.55) 806	9.43 ^c (1.41) 694	<0.001
Menstrual hygiene	1.68 (0.47) 1999	1.65 ^{a,b} (0.49) 541	1.74 ^c (0.44) 505	1.65 ^a (0.5) 516	1.69 ^{a,b,c} (0.46) 437	0.004
Health communication	0.75 (0.43) 3340	0.67 ^a (0.47) 883	0.81 ^b (0.39) 853	0.74 (0.44) ^c 860	0.79 ^b (0.41) 744	<0.001
Ability to get to doctor	3.14 (1.35) 3206	2.93 ^a (1.36) 825	3.43 ^b (1.32) 815	3.02 ^a (1.3) 838	3.19 ^c (1.36) 728	<0.001
Substance use	2.17 (0.74) 3090	2.24 ^a (0.89) 807	2.12 ^b (0.6) 796	2.17 ^{a,b} (0.74) 794	2.15 ^b (0.72) 693	0.020
Nutrition	1.65 (0.99) 2876	1.65 ^a (1.03) 728	1.71 ^a (0.95) 745	1.67 ^a (0.98) 744	1.58 ^a (1.02) 659	0.116
Safety	8.17 (2.36) 3131	7.95 ^a (2.47) 809	8.44 ^b (2.15) 809	8.01 ^a (2.42) 812	8.3 ^b (2.34) 701	<0.001
Vitality and functioning	9.83 (2.6) 3068	9.75 ^a (2.67) 799	9.84 ^a (2.56) 772	9.94 ^a (2.61) 790	9.77 ^a (2.58) 707	0.448

Note. Scores are presented as Mean (Standard Deviation); the total number of girls (*N*) is provided below scores.

Abbr. ANOVA = Analysis of variance. HC = Health curriculum. RC = Resilience Curriculum. RC + HC = Resilience + Health Curriculum. SC = School-as-usual control.

^{a,b,c} Values with the same superscripts in the same row are not significantly different at $p \leq 0.05$ for ANOVA and post-hoc tests; different superscripts indicate that the Means are significantly different.

attended schools with an average of 65.07 students for every one teacher ($SD = 30.28$). Approximately 89% had received a vaccination before ($SD = 32\%$), and they lived in homes with 2.65 people per room ($SD = 1.98$). Forty-one percent lived in Phulwarisharif, 38% in Maner, 15% in Bihta, and 6% in Maner Diyara.

We found differences across conditions on a number of covariates and outcomes at T1. For instance, girls in HC and RC attended schools with a higher student-teacher ratio than girls in RC + HC and SC, and girls in RC + HC and RC were less likely to be able to get to a doctor when needed than girls in HC or SC. In order to account for these differences, all covariates were included in regression models, thus statistically adjusting for the non-equivalency of groups at T1. Additionally, the T1 score of each outcome variable is taken into account in the models by virtue of the chosen analysis

(i.e., DID).

3.3. Outcome analyses

Examination of R^2 values for DID regressions indicated that in each case, the model including covariates explained more of the variance in the data than the unadjusted model. Thus, throughout the rest of our analyses, we use models including covariates for all outcomes. Full regression models, including covariates, are available in online supplemental file [Appendix B](#).

Table 3 summarizes relevant effect sizes (DID coefficient and significance level for each intervention's effect versus SC, which is the intervention \times time interaction term from the regression models), as well as comparisons with significance levels among

Table 3

Summary of Difference in Difference coefficients for interventions vs. control (intervention \times time interactions) and F-tests for equality among interventions.

	Intervention conditions		
	RC + HC	HC	RC
<i>Primary outcomes</i>			
Health knowledge	5.11 ^a ***	4.20 ^b ***	0.17 ^c
Gender equality attitudes	4.62 ^a ***	1.09 ^b	1.20 ^b *
<i>Secondary outcomes</i>			
Clean water behaviors	0.35 ^a ***	0.21 ^b **	0.01 ^c
Hand washing	0.35 ^a ***	0.07 ^b	0.37 ^a ***
Menstrual hygiene	0.14 ^a **	0.10 ^a *	0.12 ^a *
Health communication	0.14 ^a ***	0.06 ^b *	0.14 ^a ***
Ability to get to doctor	0.41 ^a **	-0.02 ^b	0.29 ^a *
Substance use	-0.09 ^a *	-0.11 ^a *	-0.07 ^a
Nutrition	0.13 ^a	-0.11 ^b	-0.03 ^{a,b}
Safety	0.92 ^a ***	0.42 ^b *	0.68 ^{a,b} ***
Vitality and functioning	0.57 ^{a,b} *	0.81 ^a ***	0.24 ^b

Note. Positive coefficients indicate that the intervention was more effective compared to control with the exception of Substance Use: negative coefficients indicate the intervention was superior to control.

Abbr. HC = Health curriculum. RC = Resilience curriculum. RC + HC = Resilience + Health curriculum.

^{a,b,c} Values with the same superscripts in each row do not differ at $p \leq 0.025$ (primary outcomes) or $p \leq 0.05$ (secondary outcomes); values with different superscripts differ significantly.

For primary outcomes: *** $p < 0.001$, ** $p < 0.01$, * $p \leq 0.025$ (Bonferroni correction applied). For secondary outcomes: *** $p < 0.001$, ** $p < 0.01$, * $p \leq 0.05$.

effect sizes from F-tests for equality.

3.3.1. Interventions versus SC

There was clear support for our main hypothesis that RC + HC had a greater effect than SC. This hypothesis was supported for both primary outcomes and eight out of nine secondary outcomes (all outcomes except nutrition, which was not significantly affected by any intervention versus SC).

In exploratory analyses comparing other intervention conditions to SC, we found that both HC and RC had significantly greater effects than SC. HC was more beneficial than SC for health knowledge, clean water behaviors, menstrual hygiene, health communication, substance use, safety, and vitality and functioning. RC was more beneficial than SC for gender equality attitudes, hand washing, menstrual hygiene, health communication, ability to get to a doctor when needed, and safety.

3.3.2. Intervention versus intervention

We found good support for our secondary hypothesis that RC + HC had a greater effect than HC for both primary outcomes and six out of nine secondary outcomes (clean water behaviors, hand washing, health communication, ability to get to a doctor when needed, nutrition, and safety). All other outcomes were not significantly different between RC + HC and HC.

Exploratory intervention versus intervention comparisons suggested a greater effect for RC + HC versus RC, and were less conclusive for RC versus HC. RC + HC had a greater effect than RC on both primary outcomes and one secondary outcome (clean water behaviors). All other outcomes were not significantly different between RC + HC and RC. HC had a greater effect than RC on one of two primary outcomes (health knowledge) and two secondary outcomes (clean water behaviors and vitality and functioning). RC was more beneficial than HC on three secondary outcomes (hand washing, health communication, and ability to get to the doctor when needed). Remaining outcomes were not significantly different between RC and HC.

4. Discussion

Girls First is a comprehensive, scalable program that had previously shown great promise among marginalized girls in India, but had not yet been thoroughly tested. The program combines two evidence-based curricula: the Girls First Resilience Curriculum (RC) and the Girls First Health Curriculum (HC). We designed a randomized controlled trial to compare impact on health outcomes for the different conditions against controls and against one another. We found evidence that Girls First (RC + HC) improves physical health outcomes versus control (SC), and that the improvements made by Girls First girls were greater than those achieved by the individual program components alone (RC or HC).

RC + HC significantly improved health knowledge, gender equality attitudes, clean water behaviors, hand washing, menstrual hygiene, and health communication versus SC. Additionally, participants in RC + HC reported greater ability to get to a doctor when needed, less substance use, increased feelings of safety, and higher levels of vitality and functioning relative to SC. These results clearly indicate that RC + HC is beneficial for middle school girls in rural Bihar, India across a variety of physical health indicators.

We also found that RC + HC was more beneficial than HC. Girls in RC + HC improved their health knowledge, clean water behaviors, hand washing, health communication, ability to get to a doctor, nutrition, and safety to a significantly greater extent than girls in HC. This finding is particularly interesting because the health outcomes measured were topics only during HC and not RC (with one exception: gender equality attitudes, addressed below). Thus, these results suggest that adding a resilience program to an adolescent health program amplifies physical health improvements beyond those attained by a physical health program alone, without any additional content focused on physical health.

This finding has major implications, as there are few LMIC programs dedicated to improving psychosocial wellbeing (Barry et al., 2013; Prince et al., 2007), let alone provided in combination with a health program as a strategy to improve physical health. This study therefore provides some of the first evidence that targeting psychosocial wellbeing may not only be good for LMIC girls' psychosocial health, but it may also be good for their physical health. Although nascent research in higher income countries suggests that including a significant psychosocial component in adolescent health education is effective in improving health outcomes (e.g., Gavin et al., 2010), this study is one of the first in any country to quantify the amplifying effect of this combination on physical health outcomes, versus the components alone.

Gender equality attitudes was the only topic included in both curricula. The decision to include this topic in both curricula reflects that gender equality attitudes are closely related to both physical and psychosocial wellbeing. However, each curriculum addressed gender equality attitudes from a different perspective. Gender equality in HC was dealt with from a factual knowledge-transfer standpoint, discussing gender differences, gender-based violence issues, and laws protecting girls and women from discrimination and abuse (e.g., Dworkin et al., 2011; Pulerwitz et al., 2010). RC dealt with gender equality indirectly: for instance, sessions encouraged girls to identify their strengths to help them work towards personal goals (activities drawn from positive psychology; Seligman and Csikszentmihalyi, 2000), which inherently communicated belief in girls' self-worth. Additionally, RC included one session on identifying and using psychosocial skills to oppose violence (a strategy employed by a number of social-emotional learning programs; e.g., Durlak et al., 2011), during which the topic of gender-based violence was raised given its prevalence in the community.

Results indicated that RC + HC and RC both significantly improved gender equality attitudes versus SC (the effect of HC was

marginal due to the Bonferroni correction, $p = 0.034$). RC + HC improved attitudes to a significantly greater extent than either of its components, suggesting that combining the two strategies – giving girls the psychosocial foundation for internalizing their belief in their equality to boys (through RC), combined with giving them the factual information about their rights and gender differences (through HC) – is likely more effective than either strategy alone.

Exploratory analyses comparing effects of RC versus HC demonstrated the differential impact of each of the curricula. Each curriculum affected different outcomes versus SC. Hand washing, health communication, and ability to get to the doctor were affected to a greater extent by RC than HC. Health knowledge, clean water behaviors, and vitality and functioning were affected to a greater extent by HC than RC. It is therefore likely that each curriculum has a greater effect on a certain set of health outcomes. For example, RC may have a greater effect on ability to get to a doctor because girls' parents may represent great barriers to reaching appropriate health care, as they are often reluctant to take girls to the doctor. In RC, girls learned communication skills and built confidence in self-advocacy, which may have enabled them to more successfully advocate to their parents for better care. In HC, although girls learned about the importance of getting to a doctor, when they would need to go, and what services the doctor would provide, they did not learn self-advocacy skills, thus may have been unprepared to successfully convince their parents to take them if needed. This interpretation is also supported by other results, as girls in RC + HC were able to get to the doctor to a greater extent than girls in HC, but no significant difference was found for girls in RC + HC versus RC (and no effect for HC versus SC). Additionally, girls in RC + HC and RC were more likely to tell an adult when they were sick than girls in HC (measured by health communication). Thus, it may be RC that confers the most benefit in the domain of self-advocacy and communication about health, rather than HC. Additional research will be necessary to further investigate this issue.

4.1. Limitations

This study had three main limitations: first, our reliance on self-report measures, second, the differing lengths of RC + HC and its components, and finally, that these analyses included only the time points immediately prior to and following each intervention.

4.1.1. Use of self-report measures

All measures were self-report because of logistical and resource constraints. It is therefore possible that there were biases or errors associated with self-report, such as children failing to understand questions, not taking questionnaires seriously, or lacking self-awareness to report on experiences and attitudes appropriately. To minimize these limitations, when selecting and developing measures we extensively refined questionnaires through two pilots in a similar population to ensure developmental, linguistic, and cultural appropriateness (Leventhal et al., 2015a). However, an important area of future research is to determine whether other measures, such as parent-report, teacher-report, observational, or direct bio-marker measures, can replicate these findings.

4.1.2. Length of the combined program versus individual components

RC + HC included every session from both components (44 weekly sessions), whereas girls receiving RC attended 23 weekly sessions and girls receiving HC attended 21 weekly sessions. Although this design was chosen in order to keep components of each intervention consistent across conditions, it introduces the possibility that differing intervention lengths and/or levels of

attention across conditions are responsible for the differences found. However, the pattern of results observed for girls in HC was different than that observed for girls in RC, supporting the conclusion that differences observed are not solely due to attention or length (which were fairly consistent across HC and RC) and that each intervention has its own pattern of effects. Unfortunately, the design of the study does not permit us to separate these issues further; thus, this area is important for future research to address.

4.1.3. Lack of follow-ups in analysis

This analysis stopped short of including follow-up time points. It is therefore unclear how long interventions' effects last. As it is unlikely that interventions with only short-term effects will be able to meaningfully improve health for marginalized adolescent girls in LMICs, determining how long benefits last is important. Additionally, there are a number of outcomes (such as the health behaviors and wellbeing measured as secondary outcomes) that are likely to show greater levels of change over a longer timeframe. This team intends to address these issues through future analyses of follow-up data from *Girls First – Bihar*.

4.2. Generalizability of findings

A number of considerations were made throughout the design and conduct of the trial to maximize external validity. Many of these considerations are described in detail elsewhere (Leventhal et al., 2015a), but a number of relevant points are summarized here. In order to be generalizable to a wide variety of girls in rural, high-poverty school-based settings, our study frame included girls from various castes, tribes, and religions, whom two well-known local non-profits deemed it possible to access. Interestingly, we found that the vast majority of girls invited to participate (98%) consented to participate in the study, with very low levels of attrition, indicating a remarkably high level of acceptability and interest among girls and families.

Additionally, *Girls First* was designed with scalability in mind from the outset. To that end, we used resources (human and otherwise) that would likely be available in similar communities in India and other LMICs to enhance replicability. For instance, we chose facilitators who were women from local communities with a 10th grade education and no previous experience requirements. Further, we chose measurements that were relatively short, easy-to-understand, and freely available for use (or very low cost), such that they could be feasibly used in future studies in resource-constrained areas. Thus, we believe that the findings of this study will be applicable and relevant to adolescent girls in rural schools throughout India, as well as to similar populations in other LMICs.

5. Conclusions

This study is one of the few studies worldwide to use a randomized controlled design to assess the impact of a combined psychosocial resilience and adolescent health program on health outcomes. We found that combining these two curricula amplifies the effects achieved by either curriculum alone for a highly marginalized population: adolescent girls in a rural, high-poverty, LMIC setting. Next steps will be to assess the post-intervention duration of these effects and to focus on operational questions of how best to scale such interventions to reach more marginalized girls.

This study provides some of the first empirical evidence that psychosocial resilience represents a critical missing piece in efforts to improve LMIC girls' physical health. These findings clearly suggest that efforts to improve psychosocial wellbeing should receive broader support, not only from those interested in improving

psychosocial outcomes but also from those interested in improving physical health outcomes.

Competing interests

KL, GA, and SL are employees of CorStone, the organization that conceived of and conducted this study. LD, JG, and JP are consultants to CorStone on this research.

Authors' contributions

KL participated in the design of the study, coordinated study implementation, and drafted the manuscript. LD and JG participated in the design of the study and revising the manuscript. GA coordinated the implementation of the study and assisted in revising the manuscript. JP and SL participated in the design of the study and oversight of the study's implementation. All authors read and approved the final manuscript.

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Appendix. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.socscimed.2016.05.004>.

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