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Predictors of Responsiveness Among American Indian Adolescents to a Community-Based HIV-Risk Reduction Intervention Over 12 Months

Lauren Tingey[1] · Rachel Chambers[1] · Novalene Goklish[2] · Francene Larzelere[2] · Hima Patel[1] · Angelita Lee[2] · Summer Rosenstock[1]

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Abstract
This analysis explored predictors of responsiveness to the Respecting the Circle of Life (RCL) intervention, a sexual and reproductive health program for American Indian (AI) youth. Data were collected over 12-month follow-up with 267 AI youth aged 13–19. We used mixed effects regression models to examine: (1) whether trajectory patterns of HIV/AIDS knowledge, condom beliefs, condom use self-efficacy, condom use intention and partner negotiation skills differed by baseline levels categorized into low, medium, and high scorers, and (2) the characteristics of youth who made no improvement over the post-intervention period. Results indicate the RCL intervention had greater longitudinal impact among subgroups with low and medium initial scores. High initial scores in knowledge, beliefs, efficacy, intention and skills predicted unresponsiveness to the RCL intervention. Youth differences in age, gender and school truancy (skipping/suspension) did not predict responsiveness to RCL. Results have important prevention science implications: (1) AI youth at greater risk (i.e., those with low initial levels of knowledge, beliefs, self-efficacy, intention and skills) are likely to respond to RCL and should be the target of replication and dissemination efforts. (2) Responsiveness analyses can guide adaptation of RCL and other sexual and reproductive health programs for AI youth to improve efficacy among unresponsive subgroups (i.e., high initial scorers). (3) RCL is equally likely to impact AI youth across different ages, genders and school status, thus validating population-wide implementation strategies.

Keywords American Indian/Alaska Native · Adolescent · Sexual and reproductive health · HIV/AIDS · Responsiveness

Introduction

The American Indian/Alaska Native (AI/AN) population experience disparities in sexual health. Between 2011 and 2015, the rate of gonorrhea increased 71.3% among AI/ANs to 192.8/100,000 while the U.S. national gonorrhea rate was 123.9/100,000 during that same year (Centers for Disease Control and Prevention [CDC], 2016). The U.S. national chlamydia rate in 2015 was 478.8/100,000; however, the national AI/AN rate was almost 50% higher at 709.1/100,000 (CDC, 2016). The incidence of primary and secondary syphilis for AI/ANs is 1.6 times that for non-Hispanic Whites. Further, disparities in syphilis have recently been exacerbated by a localized heterosexual outbreak in an AI reservation community with a reported 136 cases in less than 2 years (Bowen et al., 2018).

Additionally, of all U.S. groups, AI/ANs have the poorest 1-, 2- and 3-year survival post-HIV diagnosis. From 2008 to 2012, female AI/ANs were the only group in which HIV diagnosis rates increased (from 3.8/100,000 to 4.9/100,000) (Nwangwu-Ike, Hernandez, An, Huang, & Hall, 2015). In 2010 and 2011, and in comparison with other female racial groups, AI/AN females had the lowest proportion receiving treatment within 3 months of an HIV-positive diagnosis (0.1%), the lowest proportion longitudinally retained in care, and the least virally suppressed (Nwangwu-Ike et al., 2015).

AI/AN adolescents and young adults are particularly impacted by a disproportionate burden of sexually transmitted infection (STI). In 2011, female AI/ANs between ages 15–19 and 20–24 had the highest chlamydia rates in the nation at 3638.8/100,000

✉ Lauren Tingey
Ltingey1@jhu.edu

[1] Department of International Health, Center for American Indian Health, Johns Hopkins University, 415 N. Washington St., Baltimore, MD 21231, USA

[2] Department of International Health, Center for American Indian Health, Johns Hopkins University, Whiteriver, AZ, USA

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and 4773.6/100,000, respectively (CDC & Indian Health Service [IHS], 2014). From the years 2007–2011, the majority (69% and 59%) of all AI/AN chlamydia and gonorrhea cases were among youth ages 13–24 years old (Walker et al., 2015). Early sexual initiation increases the likelihood of engaging in risk behaviors resulting in STIs, and national data indicate that AI/AN youth more often initiate sex before age 13 compared with all other groups, with the exception of Black/African-American youth (CDC, 2015).

Such inequalities cannot be adequately addressed unless AI/ANs participate in intervention and rigorous evaluation research (Yancey, Ortega, & Kumanyika, 2006). AI/ANs have been included as a small proportion of total sample size in large efficacy trials of interventions addressing: Type II diabetes (adults), parenting promotion through home visiting (adults), substance use (adolescents), and conflict resolution (adolescents) (Aber, Brown, & Jones, 2003; Diabetes Prevention Program Research Group et al., 2009; Kulis et al., 2005; Olds et al., 2002, 2004). Further, evaluations of sexual health interventions involving exclusive samples of AI/ANs, and specifically adolescents who shoulder the greatest burden of inequities, are few (Craig & Gardner, 2016; Kaufman et al., 2014). These research deficits are exacerbated by general under-representation of minor-aged adolescents in clinical trials, despite heightened risk for STIs (Hoffman et al., 2016).

To address aforementioned sexual health disparities, we evaluated a culturally adapted evidence-based intervention (EBI) for HIV-risk reduction called: "Respecting the Circle of Life: Mind, Body and Spirit" (RCL). The RCL intervention was adapted from Focus on Youth (FOY), which has been replicated and evaluated longitudinally in several countries and across diverse cultural contexts (Gong et al., 2009; Kaljee et al., 2005; Li, Stanton, Feigelman, & Galbraith, 2002; Lwin, Stanaland, & Chan, 2010; Stanton et al., 1996). FOY has been shown to increase youth's HIV knowledge, condom use self-efficacy, and condom use intention, and to decrease unprotected sex among sexually active youth (Chen et al., 2010; Deveaux et al., 2007; Stanton et al., 1996, 1997). RCL was adapted through a partnership between a reservation-based tribal community and an academic institution (Tingey et al., 2015a). RCL has been evaluated longitudinally with an exclusive sample of AI adolescents, and found to improve HIV knowledge, condom use self-efficacy, condom use intention, partner negotiation, belief condoms prevent pregnancy and infection, and talking with family about HIV/AIDS (Tingey et al., 2015a, 2017). RCL is currently being replicated with additional tribal communities in the Southwestern USA.

While sexual health programs, such as RCL, have been evaluated utilizing an intent to treat analysis, interventions may have varying impact among subgroups with certain characteristics and should be considered in the context of within group variation (Barrera, Castro, Strycker, & Toobert, 2013; Castro, Barrera, & Holleran Steiker, 2010; Wang et al., 2013). Understanding intervention responsiveness may be useful to guide program modification to improve efficacy among unresponsive subgroups. Such research may also aid with dissemination decisions, particularly salient for AI/AN populations where few sexual and reproductive health EBIs are available for replication. RCL is one of the first of such programs with demonstrated efficacy among AI/AN adolescents, and now undergoing scaling (Tingey et al., 2015a). Understanding how baseline levels of primary outcomes of interest impact change in those outcomes post-intervention is an important next step in this line of research and a major focus of this article.

Although some studies assessing the differential impact of HIV-risk reduction interventions have been conducted among African and African-American youth, none published to date have conducted this type of analysis among AI/AN adolescents (Chen, Murphy, Naar-King, Parsons, & Adolescent Medicine Trials Network for HIV/AIDS Interventions, 2011; Miller et al., 2011; Ross et al., 2007; Wang et al., 2013). Several behavior-change models including the theory of planned behavior, theory of reasoned action and the protection motivation theory (the framework from which RCL was developed) illustrate how sociodemographic variables such as age, sex, race/ethnicity and education, in addition to baseline levels of key outcomes of interest, may moderate relationships between health beliefs and behaviors, and thus likely to influence intervention responsiveness (Rogers, 1983).

Research from the broader literature exploring these relationships has been mixed. A meta-analysis of school-based HIV-risk reduction programs for African youth found greater responsiveness among young, sexually inexperienced participants (Gallant & Maticka-Tyndale, 2004). Another study in Uganda found HIV-risk reduction information campaigns had greater responsiveness among youth with higher levels of education (De Walgue, 2004). Turning to the U.S., an HIV-risk reduction program evaluated among juniors and seniors in high school showed greater efficacy among boys than girls (Caron, Godin, Otis, & Lambert, 2004).

In a responsiveness analysis of FOY intervention impact among Bahamian youth, results showed high initial scores in knowledge, skills, self-efficacy, and intention predicted unresponsiveness (Wang et al., 2013). In that same study, younger youth and those that were female had improved HIV/AIDS knowledge after receiving FOY, while male gender was associated with improved self-efficacy. In contrast with the study conducted in Uganda, Bahamian youth receiving FOY with higher academic achievement at baseline showed less improvement in condom use intention after receiving the intervention than youth with lower academic achievement.

Other research conducted with this population of AI/AN adolescents holds clues about what factors are likely to influence responsiveness specifically to RCL. In a qualitative analysis of sexual risk behaviors, girls were motivated to engage in sex for

internal satisfaction and less likely to use condoms because of a desire to become pregnant; whereas boys were motivated to have sex and not use condoms based on external rewards such as positive peer response and social status (Chambers et al., 2016). We also conducted a quantitative analysis of the protection motivation theoretical predictors of condom use intention among boys and girls. Among girls, extrinsic rewards (peer/social influence), intrinsic rewards (internal feelings) and response efficacy (belief that condoms effectively prevent STIs and pregnancy) predicted condom use intention (Chambers et al., 2018). Among boys, extrinsic rewards, response efficacy, severity (seriousness of becoming infected with a STI or pregnancy), and vulnerability (to STIs and unintended pregnancy) predicted condom use intention (Chambers et al., 2018). Based on this research, we hypothesized that there would be no difference in RCL responsiveness between girls and boys.

The purpose of this analysis was to explore whether initial levels of: (1) HIV prevention and transmission knowledge, (2) belief that condoms prevent pregnancy and infection, (3) condom use self-efficacy, (4) condom use intention and (5) partner negotiation skills on condom use, predicted changes in the longitudinal trends of mean scores for these variables. We also sought to ascertain individual predictive factors for unresponsiveness to the RCL intervention. Our research questions were: (1) Did trajectory patterns of knowledge, beliefs, self-efficacy, intention and skills differ by pre-intervention levels of knowledge, beliefs, self-efficacy, intention, and skills categorized into low, medium and high scorers? (2) What are characteristics of youth who made no improvement in their knowledge, beliefs, self-efficacy, intention, and skills over the 12-month post-intervention period? This analysis is the first assessing the differential impact of a culturally adapted EBI for HIV-risk reduction among an exclusive sample of AI/AN youth. As stated, the RCL program is currently undergoing replication with other tribal communities. Results from this analysis will inform dissemination efforts and may suggest targeting specific subgroups of youth at baseline for program implementation.

Method

Participants

Participants included 267 American Indian youth ages 13–19 recruited from the participating tribal community (who will remain anonymous by request and due to the sensitive topic of this research), and reside in a rural, reservation-based context in the Southwestern part of the U.S. The tribe endures notable challenges including high rates of poverty and unemployment as well as low rates of high school completion and college matriculation. Local rates of STIs (which will not be reported here to protect the identity of the tribal community) corroborate national disparities and are perpetuated by the absence of standardized health education in school curriculum and a lack of supplemental community-based programming. Thus, the cultural adaptation and rigorous evaluation of an EBI for HIV-risk reduction is highly justified.

Intervention and Control Program Description

RCL was adapted from FOY by our tribal–academic partnership. FOY is an EBI for HIV-risk reduction included in the "Diffusion of Behavioral Intervention" portfolio of the Centers for Disease Control and Prevention (https://effectiveinterventions.cdc.gov). A detailed description of the adaptation of FOY and evaluation of RCL can be found in previous publications (Chambers et al., 2016; Tingey et al., 2015a, b, 2017). Briefly, RCL is a community-based program consisting of 8 sessions, each 90–120 min in length, taught daily during a summer basketball camp, and based on protection motivation theory (Rogers, 1983). The control condition consists of 8 educational lessons taught through lecture and hands-on activities covering nutrition, fitness, and tribal history (there was no content overlap with RCL).

Randomization

On the first day of camp, participants formed self-selected peer groups, also called "teams" of the same gender and age range (13–15 and 16–19). Youth were instructed to form groups with people they already knew such as friends, siblings and/or other family members. Through a randomization sequence created by the study data manager in Stata 9.0 (StataCorp, 2005), peer-group "teams" were cluster randomized to receive RCL or control. There was a total of 30 teams with 7–12 participants per team; 16 were randomized to RCL and 14 to control. This resulted in 138 participants randomized to RCL and 129 to control. After randomization, youth in each group (RCL or control) were brought to separate facilities where they remained for the duration of camp. Peer-group randomization and the use of distinct locations were the two primary methods utilized to limit cross-contamination of RCL content on the control group.

Procedure

Data were collected through 4 assessments: baseline, immediately after camp and 6- and 12-month post-intervention. The follow-up rate was 96.3% post-camp, 87.6% at 6 months, and 89.5% at 12 months. Baseline mean participant age was 15.1 years (SD 1.7) and 56% were female. Data were collected using the Youth Health Risk Behavior Inventory (YHRBI), a self-report questionnaire administered via hard copy, culturally

tailored and pilot tested with input from the participating tribal community (Stanton et al., 1995; Tingey et al., 2015b). Confirmatory factor analysis examined relevance of YHRBI subscales to our study population; items were removed if they greatly diminished the Cronbach's alpha value for a particular factor (Stanton et al., 1995; Tingey et al., 2015b). The YHRBI took approximately 30–45 min to complete at each administration. Participants received gift cards for completing follow-up surveys ($15, $25, and $25, respectively), but not at baseline. Parental permission and assent were obtained for participants ages 13–17 and consent for participants ages 18–19. The study was approved by relevant tribal and University research review boards. This manuscript was approved by the governing body of the participating tribal community.

Measures

The five outcome variables selected were based on our past impact analyses and parallel analyses of FOY conducted by Wang et al. (2013); we list Cronbach's alpha at baseline for each outcome (Tingey et al., 2015b). A 21-item scale including true and false statements assessed HIV prevention and transmission knowledge (e.g., "HIV/AIDS can be cured if treated early," $\alpha = 0.73$). Knowledge was scored based on the percent of questions correctly answered. The belief condoms prevent STI, HIV and pregnancy was assessed using three items with a Likert scale (range 1–5; 1 = strongly disagree, 5 = strongly agree) (e.g., "condoms are an important way to prevent you from getting a STI," $\alpha = 0.78$). A mean score was calculated across the three questions. Condom use self-efficacy was assessed by six items with a Likert scale (range 1–5; 1 = No, I could not, 5 = Yes, I could) (e.g., "I could get condoms," $\alpha = 0.83$). A mean score was calculated across the six questions. *Condom use intention* was measured using the following question: "In the next 6 months I will use a condom if I have sex." Youth responded using a Likert scale (range 1–5; 1 = No, 2 = Probably Not, 3 = Don't Know, 4 = Maybe, 5 = Yes). Eight items with Likert scale response options (range 1–4; 1 = very difficult, 4 = Not difficult at all) assessed partner negotiation skills on condom use (e.g., "how difficult would it be for you to ask a casual partner to use a condom, even if it might make them think you have a STI," $\alpha = 0.94$). A mean score was calculated across the eight items. For each outcome, dichotomous variables were created to reflect responsiveness to RCL. Participants were categorized as unresponsive on each of the five outcomes if their scores did not increase from baseline at any time point. If the score increased, but then reverted to baseline levels or lower by 12-month follow-up, they were also considered unresponsive.

Analysis

Statistical analyses were carried out using Stata 14 statistical software (StataCorp, 2015). All outcome variables were coded so a higher score reflected a better outcome. Means and standard deviations for each outcome were calculated for each time point. Within and between group differences were tested using mixed effects regression models with a random effect for self-selected peer-group clusters. All models were adjusted for repeated measures. Independent variables included time point, study group and an interaction term between time point and study group. The adjusted means at each time point were graphed by group (intervention vs. control).

Baseline data for each outcome were then stratified into low (< 25th percentile), medium (25th–75th percentile) and high (> 75th percentile) categories. Condom use intention was not split perfectly at these percentiles because such a large proportion reported condom use intention. So, this variable was stratified as close as possible to the specified percentiles. Mixed effects models were rerun to examine whether between study group changes in targeted outcomes over time differed by baseline level of the outcome. Independent variables included time point, study group, baseline categories of the target outcome (low, medium and high), two-way interaction terms between time point and study group, time point and baseline categories of target outcome, and study group and baseline categories of target outcome, and a three-way interaction term between time point, study group, and baseline categories of target outcome. Adjusted means for each time point were graphed by study group and baseline level of target outcome (low, medium and high). Models were adjusted for repeated measures, and a random effect for self-selected peer group was included.

Dichotomous variables indicating which participants did not improve their scores over 12 months (non-responders) and which did (responders) were created for each outcome. Multi-level mixed effects logistic regression models, with a random effect for self-selected peer-group clusters, were used to determine which factors were predictive of non-response to the RCL intervention. Independent variables included categorical (low, medium and high) baseline scores for each outcome, study group (intervention vs. control), age, gender, currently attends school, has missed school due to skipping, and has missed school due to suspension. The analytic approach utilized is appropriate for understanding how baseline levels of knowledge, condom beliefs, condom use self-efficacy, condom use intention and partner negotiation impact responsiveness to the RCL program.

Table 1 Sample characteristics of participants

	Total ($N=267$)	Control ($N=129$)	Intervention ($N=138$)	p value
Gender—female: % (n)	56.2% (150)	55.0% (71)	57.3% (79)	.7164
Age: mean (SD)	15.1 (1.7)	14.8 (1.5)	15.4 (1.7)	.0018
Currently in school[a]: % (n)	93.3% (236)	94.2% (113)	92.5% (123)	.5929
Ever suspended[b]: % (n)	29.8% (77)	29.8% (37)	29.9% (40)	1.0000
Skipped school last semester[c]: % (n)	23.6% (61)	22.4% (28)	24.6% (33)	.6730
Have boyfriend/girlfriend[d]: % (n)	35.4% (92)	42% (33.3)	50% (37.3)	.5024
Ever had anal or vaginal sex: % (n)	22.5% (60)	18.6% (24)	26.1% (36)	.1433

The data collection instrument, including the collection of sample characteristic data, was based on Stanton et al.'s (1995) Youth Health Risk Behavior Inventory, and further refined through feedback gleaned by the tribal–academic partnership during the adaptation of focus on youth into the Respecting the Circle of Life program

[a]Control: $N=120$, intervention: $N=133$

[b]Control: $N=124$, intervention: $N=134$

[c]Control: $N=125$, intervention: $N=134$

[d]Control: $N=126$, intervention: $N=134$

Results

Sample Characteristics

Please see Table 1 for details regarding the sample (complete characteristics have been previously published) (Tingey et al., 2015a). Youth were on average 15.1 years old, with a significant difference between groups that has been adjusted for all in all analyses (RCL = 15.4 vs. control = 14.8, $p=.0018$). More youth were female (56.2%) and the majority were currently in school (93.3%). Almost a third had ever been suspended (29.8%) and nearly one quarter had skipped school in the last semester (23.6%). Over a third had a boy/girlfriend (35.4%) and 22.5% had ever had vaginal or anal sex in their lifetime.

Longitudinal Trends in Primary Outcomes

Intervention Group

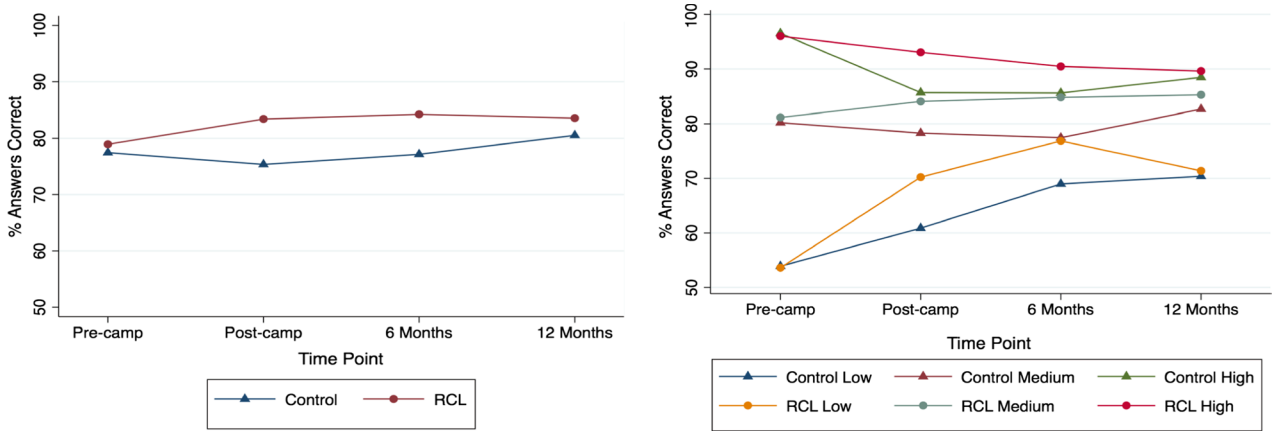
Figures 1, 2, 3, 4, and 5 illustrate the longitudinal trends of the five primary outcomes examined: HIV prevention/transmission knowledge, condom belief, condom use self-efficacy, condom use intention and partner negotiation skills. In the intervention group, there were statistically significant increases in all five outcomes between baseline and 12 months follow-up (HIV prevention/transmission knowledge: mean percent correct: 78.94% vs. 83.58%, $p=.001$; condom belief: 3.80 vs. 4.24, $p<.0001$; condom use self-efficacy: 3.46 vs. 4.34, $p<.0001$; condom use intention: 3.88 vs. 4.22, $p=.026$; and partner negotiation skills: 2.54 vs. 2.89, $p<.0001$). The largest increases were consistently observed between baseline and post-camp, with the exception of partner negotiation for which there was a steady increase over time. Gains were maintained through 12-month follow-up for HIV prevention/transmission knowledge, condom use self-efficacy and condom use intention. A small decrease was observed between post-camp and 12-month follow-up for condom belief.

Control Group

In the control group, statistically significant increases between baseline and 12-month follow-up were only observed for three of the five outcomes (HIV prevention/transmission knowledge: mean percent correct: 77.46% vs. 80.53%, $p=.036$; condom belief: 3.94 vs. 3.91, $p=.730$; condom use self-efficacy: 3.37 vs. 3.97, $p<.0001$; condom use intention: 3.77 vs. 4.08, $p=.056$; and partner negotiation skills: 2.45 vs. 2.88, $p<.0001$). Unlike the intervention group, control group means that statistically significantly increased from baseline to 12 months did so steadily across time points rather than immediately post-camp.

Intervention versus Control Group

Improvements in HIV prevention/transmission knowledge were statistically significantly greater in the intervention group compared to the control group from baseline to post-camp ($p=.001$) and baseline to 6-month follow-up ($p=.007$). Improvements were statistically significantly greater across all time points in the intervention group compared to the control group for condom beliefs (post-camp, 6 months and 12 months p value $<.0001$) and condom use self-efficacy (post-camp and 6 months p value $<.0001$; 12 months $p=.008$). Baseline to post-camp was the only time point for which the improvement in condom use intention was statistically significantly greater in the intervention group versus the control group ($p=.006$), and there were no statistically significant differences in partner negotiation across time points between intervention and control groups.



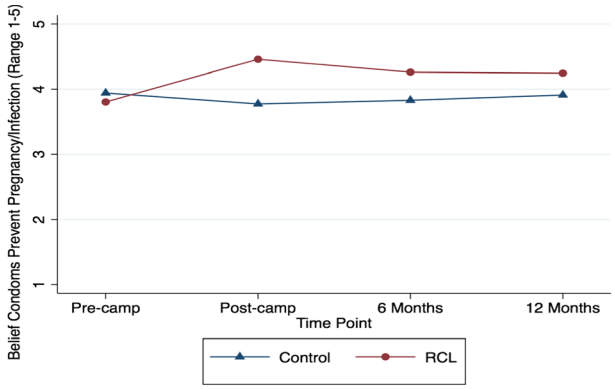
HIV Prevention/transmission knowledge		Control Mean (SE)	p-value[1]	RCL Mean (SE)	p-value[2]	p-value[3]
Un-Stratified	Pre-Camp	77.46 (1.67)	Ref	78.94 (1.61)	Ref	.522
N=263	Post-Camp	75.36 (1.68)	.139	83.42 (1.62)	.001	.001
	6-Months Post-Camp	77.16 (1.73)	.840	84.23 (1.64)	<.0001	.007
	12-Months Post-Camp	80.53 (1.72)	.036	83.58 (1.63)	.001	.444
Stratified by Baseline Levels of HIV Prevention/Transmission Knowledge (N=263)						
Low	Pre-Camp	53.89 (2.26)	Ref	53.60 (2.32)	Ref	.931
n=62	Post-Camp	60.88 (2.12)	.004	70.23 (2.20)	<.0001	.006
	6-Months Post-Camp	68.98 (2.14)	<.0001	76.86 (2.18)	<.0001	.021
	12-Months Post-Camp	70.40 (2.32)	<.0001	71.38 (2.35)	<.0001	.738
Medium	Pre-Camp	80.21 (1.58)	Ref	81.14 (1.51)	Ref	.669
n=132	Post-Camp	78.29 (1.66)	.291	84.06 (1.58)	.092	.054
	6-Months Post-Camp	77.45 (1.66)	.105	84.81 (1.59)	.026	.007
	12-Months Post-Camp	82.65 (1.73)	.192	85.28 (1.63)	.020	.514
High	Pre-Camp	96.53 (2.08)	Ref	96.01 (2.00)	Ref	.857
n=69	Post-Camp	85.68 (2.08)	<.0001	93.05 (2.05)	.136	.005
	6-Months Post-Camp	85.61 (2.49)	<.0001	90.46 (2.25)	.023	.136
	12-Months Post-Camp	88.46 (2.34)	.001	89.62 (2.23)	.008	.630
Control Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = .001$						
RCL Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p < .0001$						

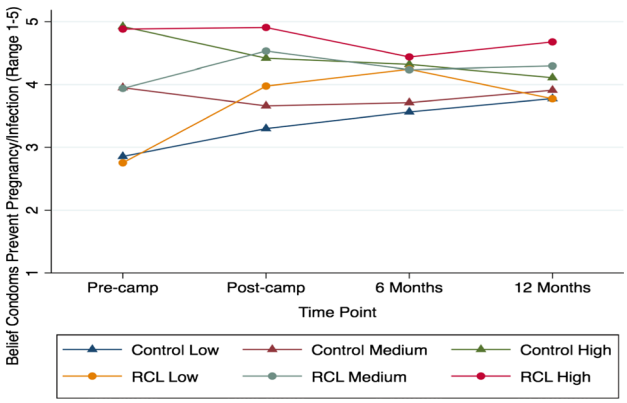
[1] Comparison with baseline within control group
[2] Comparison with baseline within RCL group
[3] RCL (Time point-Pre-Camp) - Control (Time point – Pre-Camp)

Fig. 1 Change in HIV prevention/transmission knowledge through 12-month post-intervention. Low scorers in both intervention and control groups had statistically significant improvements in HIV prevention/transmission knowledge baseline to 12-month follow-up. Medium scorers showed smaller improvements, with statistically significant increases only observed among those in the intervention group at 6 and 12 months. High scorers did not improve and actually significantly decreased between baseline and 12 months

Baseline to 12-Month Trajectories Stratified by Baseline Levels of Primary Outcomes

For each outcome, control and intervention trajectories were stratified by the initial baseline levels (low, medium and high baseline scorers). In both study groups, all five outcomes showed statistically significantly greater baseline to 12-month improvements among low initial scorers compared to medium and high initial scorers. While medium initial scorers had more modest improvements, they remained statistically significantly greater than high initial scorers in both study groups. There was a large increase from baseline to post-camp in the





Condom Beliefs		Control Mean (SE)	p-value[1]	RCL Mean (SE)	p-value[2]	p-value[3]
Un-Stratified N=259	Pre-Camp	3.94 (0.08)	Ref	3.80 (0.07)	Ref	.197
	Post-Camp	3.77 (0.08)	.052	4.46 (0.07)	<.0001	<.0001
	6-Months Post-Camp	3.83 (0.08)	.213	4.26 (0.08)	<.0001	<.0001
	12-Months Post-Camp	3.91 (0.08)	.730	4.24 (0.08)	<.0001	<.0001
Stratified by Baseline Levels of Beliefs Condoms Prevent Pregnancy/Infection (N=259)						
Low n=67	Pre-Camp	2.85 (0.13)	Ref	2.75 (0.12)	Ref	.566
	Post-Camp	3.30 (0.12)	.003	3.98 (0.12)	<.0001	<.0001
	6-Months Post-Camp	3.56 (0.12)	<.0001	4.25 (0.12)	<.0001	<.0001
	12-Months Post-Camp	3.78 (0.13)	<.0001	3.77 (0.13)	<.0001	.653
Medium n=107	Pre-Camp	3.95 (0.09)	Ref	3.93 (0.08)	Ref	.922
	Post-Camp	3.66 (0.09)	.009	4.53 (0.09)	<.0001	<.0001
	6-Months Post-Camp	3.71 (0.10)	.023	4.23 (0.09)	.003	<.0001
	12-Months Post-Camp	3.91 (0.10)	.726	4.29 (0.09)	.001	.011
High n=85	Pre-Camp	4.92 (0.11)	Ref	4.88 (0.13)	Ref	.813
	Post-Camp	4.42 (0.12)	<.0001	4.91 (0.14)	.844	.003
	6-Months Post-Camp	4.32 (0.13)	<.0001	4.44 (0.15)	.010	.483
	12-Months Post-Camp	4.11 (0.13)	<.0001	4.68 (0.16)	.245	.008
Control Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p < .0001$						
RCL Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = .005$						

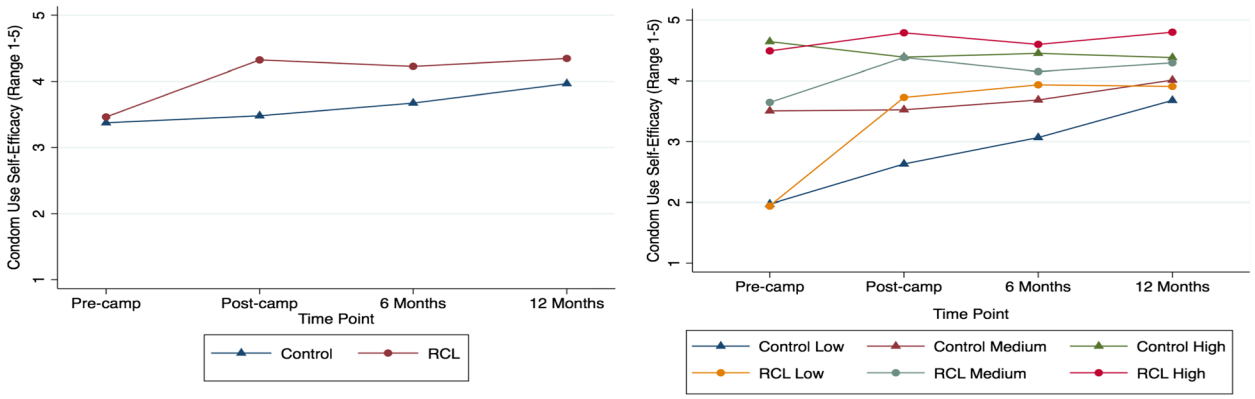
[1] Comparison with baseline within control group
[2] Comparison with baseline within RCL group
[3] RCL (Time point-Pre-Camp) - Control (Time point – Pre-Camp)

Fig. 2 Change in belief condoms prevents pregnancy/infection through 12-month post-intervention. Improvements baseline to 12-month follow-up among low initial scorers in both intervention and control were statistically significantly greater than the changes observed among medium and high initial scorers, with trajectories in both groups remaining significantly better than high scorers

intervention group among low and medium initial scorers for all variables except partner negotiation. These gains were mostly maintained through 12 months. Statistically significant increases in the control group among low and medium initial scorers were more gradual over the course of the 12 month study period. High initial scorers either remained stable or decreased from baseline to 12 months.

HIV Prevention/Transmission Knowledge

Figure 1 shows that low scorers in both groups had statistically significant improvements in HIV prevention/transmission knowledge baseline to 12-month follow-up. While those in the control group steadily increased over the course of the year, those in the intervention group showed a large increase baseline to post-camp, and maintained these gains through 12-month

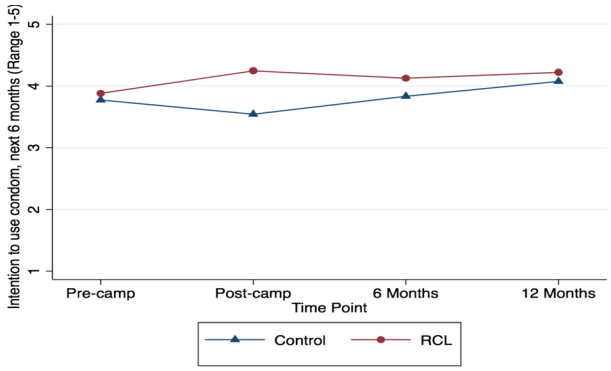


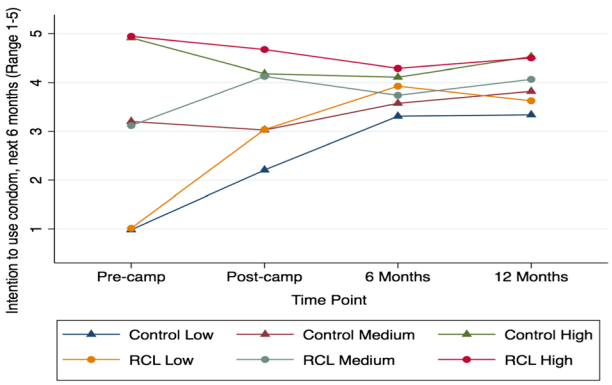
Condom use Self-Efficacy		Control Mean (SE)	p-value[1]	RCL Mean (SE)	p-value[2]	p-value[3]
Un-Stratified N=258	Pre-Camp	3.37 (0.09)	Ref	3.46 (0.09)	Ref	.492
	Post-Camp	3.48 (0.09)	<.0001	4.32 (0.09)	<.0001	<.0001
	6-Months Post-Camp	3.67 (0.10)	<.0001	4.22 (0.09)	<.0001	<.0001
	12-Months Post-Camp	3.97 (0.10)	<.0001	4.34 (0.09)	<.0001	.008
Stratified by Baseline Levels of Condom Use Self-Efficacy (N=258)						
Low n=60	Pre-Camp	1.97 (0.13)	Ref	1.94 (0.12)	Ref	.873
	Post-Camp	2.63 (0.12)	<.0001	3.72 (0.12)	<.0001	<.0001
	6-Months Post-Camp	3.07 (0.13)	<.0001	3.94 (0.12)	<.0001	<.0001
	12-Months Post-Camp	3.68 (0.14)	<.0001	3.91 (0.13)	<.0001	.195
Medium n=136	Pre-Camp	3.51 (0.08)	Ref	3.65 (0.08)	Ref	.230
	Post-Camp	3.53 (0.08)	.828	4.38 (0.09)	<.0001	<.0001
	6-Months Post-Camp	3.69 (0.08)	.030	4.15 (0.09)	<.0001	.006
	12-Months Post-Camp	4.02 (0.08)	<.0001	4.30 (0.09)	<.0001	.262
High n=62	Pre-Camp	4.64 (0.13)	Ref	4.49 (0.11)	Ref	.362
	Post-Camp	4.39 (0.13)	.022	4.79 (0.11)	.003	<.0001
	6-Months Post-Camp	4.45 (0.15)	.188	4.60 (0.12)	.365	.111
	12-Months Post-Camp	4.38 (0.15)	.083	4.80 (0.12)	.010	.003
Control Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p < .0001$						
RCL Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = .019$						

[1] Comparison with baseline within control group
[2] Comparison with baseline within RCL group
[3] RCL (Time point-Pre-Camp) - Control (Time point – Pre-Camp)

Fig. 3 Change in condom use self-efficacy through 12-month post-intervention. Low and medium initial scorers in both groups had statistically significant increases in condom use self-efficacy from baseline to 12 months. High scorers in the control group showed a statistically insignificant decrease in condom use self-efficacy between baseline and 12 months, while high scorers in the intervention group had a statistically significant increase from baseline to 12 months

follow-up. By 12 months, scores were comparable across study groups among low initial scorers. Improvements among low initial scorers between baseline and 12 months were statistically significantly greater than medium or high initial scorers. Medium scorers showed smaller improvements, with statistically significant increases only observed among those in the intervention group at 6 and 12 months. High scorers did not improve and actually significantly decreased between baseline and 12 months, with those in the control group decreasing immediately post-camp and those in the intervention group declining more slowly over time. Although medium scorers' improvements were more modest than low scorers, their trajectories were significantly better than high scorers. While low scorers showed the greatest improvement, they were still below the overall study group-specific means at 12 months (control: 70.40% vs. 80.53%; intervention: 71.38% vs. 83.58%). High





Condom use Intention		Control Mean (SE)	p-value[1]	RCL Mean (SE)	p-value[2]	p-value[3]
Un-Stratified N=260	Pre-Camp	3.77 (0.14)	Ref	3.88 (0.13)	Ref	.577
	Post-Camp	3.54 (0.14)	.132	4.25 (0.14)	.015	.006
	6-Months Post-Camp	3.84 (0.15)	.704	4.13 (0.14)	.109	.402
	12-Months Post-Camp	4.08 (0.14)	.056	4.22 (0.13)	.026	.863
Stratified by Baseline Levels of Condom Use Intention (N=260)						
Low n=45	Pre-Camp	0.99 (0.24)	Ref	1.01 (0.26)	Ref	.930
	Post-Camp	2.21 (0.23)	<.0001	3.04 (0.23)	<.0001	.062
	6-Months Post-Camp	3.31 (0.23)	<.0001	3.93 (0.24)	<.0001	.180
	12-Months Post-Camp	3.34 (0.27)	<.0001	3.63 (0.26)	<.0001	.581
Medium n=51	Pre-Camp	3.20 (0.23)	Ref	3.12 (0.21)	Ref	.784
	Post-Camp	3.03 (0.25)	.547	4.13 (0.23)	<.0001	.003
	6-Months Post-Camp	3.58 (0.24)	.123	3.74 (0.22)	.008	.460
	12-Months Post-Camp	3.82 (0.25)	.037	4.07 (0.23)	.001	.417
High n=164	Pre-Camp	4.92 (0.14)	Ref	4.94 (0.14)	Ref	.885
	Post-Camp	4.18 (0.14)	<.0001	4.67 (0.14)	.106	.049
	6-Months Post-Camp	4.11 (0.16)	<.0001	4.29 (0.15)	<.0001	.563
	12-Months Post-Camp	4.53 (0.16)	.034	4.50 (0.15)	.013	.831
Control Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = .003$						
RCL Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = <.0001$						

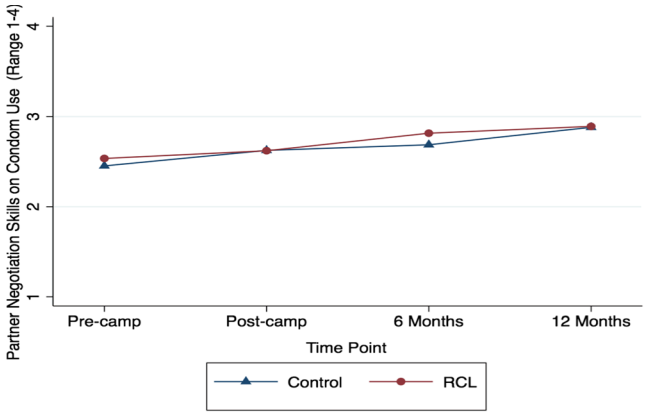
[1] Comparison with baseline within control group
[2] Comparison with baseline within RCL group
[3] RCL (Time point-Pre-Camp) - Control (Time point – Pre-Camp)

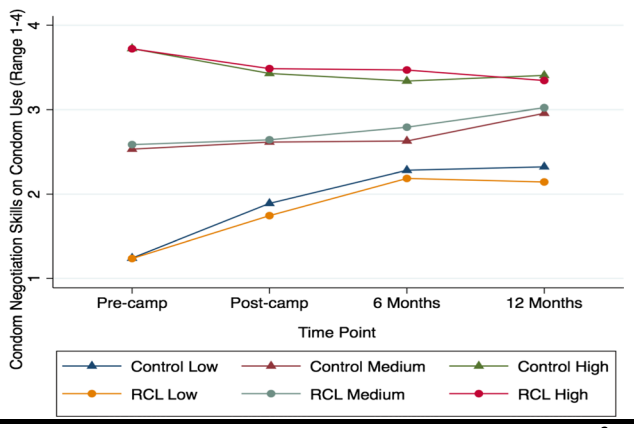
Fig. 4 Change in condom use intention through 12-month post-intervention. Low initial scorers in both intervention and control groups in condom use intention had the greatest increases baseline to 12 months. Medium scorers in both groups had statistically significant baseline to 12-month improvements. High scorers in both groups experienced a statistically significant decline in condom use intention over 12 months, but also maintained the highest condom use intention score at 12 months across all groups

scorers, despite their decreases, had higher scores than the study group means at 12 months (control: 88.46%, intervention: 89.62%).

Condom Belief

The greatest improvements baseline to 12 months in condom belief were observed among low initial scorers (intervention: 2.75 vs. 3.77, $p < .0001$; control: 2.85–3.78, $p < .0001$) (see Fig. 2). While the baseline to 12 month change was similar within the low scorers across study groups, youth receiving RCL showed statistically significantly greater improvements post-camp and at 6-month follow-up. At 12-month follow-up, improvements within the intervention group began to wane. Within the intervention group, modest statistically significant baseline to 12 month improvements were observed among medium scorers, while those in the control group were nearly unchanged (intervention: 3.93–4.29, $p = .001$; control: 3.95–3.91,





Partner Negotiation on Condom Use		Control Mean (SE)	p-value[1]	RCL Mean (SE)	p-value[2]	p-value[3]
Un-Stratified N=244	Pre-Camp	2.45 (0.10)	Ref	2.54 (0.09)	Ref	.543
	Post-Camp	2.63 (0.10)	.020	2.62 (0.09)	.242	.407
	6-Months Post-Camp	2.69 (0.10)	.002	2.82 (0.09)	<.0001	.670
	12-Months Post-Camp	2.88 (0.10)	<.0001	2.89 (0.09)	<.0001	.501
Stratified by Baseline Levels of Partner Negotiation on Condom Use (N=244)						
Low n=63	Pre-Camp	1.24 (0.12)	Ref	1.24 (0.12)	Ref	.975
	Post-Camp	1.89 (0.11)	<.0001	1.74 (0.11)	<.0001	.432
	6-Months Post-Camp	2.28 (0.12)	<.0001	2.19 (0.11)	<.0001	.621
	12-Months Post-Camp	2.32 (0.12)	<.0001	2.14 (0.13)	<.0001	.377
Medium n=116	Pre-Camp	2.53 (0.08)	Ref	2.59 (0.08)	Ref	.637
	Post-Camp	2.62 (0.08)	.364	2.64 (0.08)	.541	.833
	6-Months Post-Camp	2.63 (0.08)	.268	2.79 (0.08)	.017	.372
	12-Months Post-Camp	2.96 (0.09)	<.0001	3.02 (0.09)	<.0001	.945
High n=65	Pre-Camp	3.72 (0.12)	Ref	3.72 (0.11)	Ref	.985
	Post-Camp	3.43 (0.12)	.008	3.49 (0.11)	.027	.694
	6-Months Post-Camp	3.34 (0.15)	.012	3.47 (0.12)	.057	.508
	12-Months Post-Camp	3.41 (0.14)	.035	3.34 (0.12)	.004	.770
Control Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .0001$						
Low vs. High: $p < .0001$						
Medium vs. High: $p < .0001$						
RCL Trajectory Comparisons (Baseline to 12 Months)						
Low vs. Medium: $p < .005$						
Low vs. High: $p < .0001$						
Medium vs. High: $p = <.0001$						

[1] Comparison with baseline within control group
[2] Comparison with baseline within RCL group
[3] RCL (Time point-Pre-Camp) - Control (Time point – Pre-Camp)

Fig. 5 Change in partner negotiation skills on condom use through 12-month post-intervention. Baseline to 12-month improvements was statistically significantly greater in low baseline scorers compared to medium and high baseline scorers in both study groups. While medium baseline scorers' improvements were smaller than low baseline scorers, the baseline to 12-month trajectories remained statistically significantly better than those in the high initial scoring group across both study groups. Those whose baseline scores were the highest declined over 12 months, but remained higher than other groups

$p=.726$). Among medium scorers, changes were statistically significantly greater at all time points in the intervention group compared to the control group. Baseline to 12-month decreases were observed in both study groups among high scorers; however, decreases were only statistically significant in the control group (intervention: 4.88–4.68, $p=.245$; control: 4.92–4.11, $p<.0001$). Improvements baseline to 12-month follow-up among low initial scorers in both study groups were statistically significantly greater than the changes observed among medium and high initial scorers. While medium scorers had smaller improvements than low scorers, the trajectories in both groups remained significantly better than high scorers.

Condom Use Self-Efficacy

Like other variables, low and medium initial scorers in both groups had statistically significant increases in condom use self-efficacy from baseline to 12 months. Increases were statistically significantly greater among low initial scorers (control: 1.97–3.68, $p < .0001$; intervention: 1.94–3.91, $p < .0001$) compared to medium and high initial scorers (see Fig. 3). While low initial scorers in the control group showed a steady increase over time, the intervention group showed a large increase post-camp and then remained steady through 12 months. Increases in baseline to post-camp ($p < .0001$) and baseline to 6 months ($p < .0001$) were statistically significantly greater among intervention youth compared to control youth. Although the slopes were no longer statistically significantly different at 12-month follow-up, the intervention group remained higher than the control group. Medium initial scorers followed the same trends over 12 months as low scorers, but with smaller increases (control: 3.51–4.02, $p < .0001$; intervention: 3.65–4.30, $p < .0001$). Like low baseline scorers, the majority of the increase observed in the intervention group occurred post-camp and then held steady through 12-month follow-up, while there were no increases in the control group until 6-month follow-up, and then a steady increase was observed through 12 months. The differences in trajectory were statistically significant post-camp ($p < .0001$) and at 6-month follow-up ($p = .006$), with intervention youth showing greater gains. While the difference was no longer significant at 12-month follow-up, intervention youth scores remained higher than control youth scores. Baseline to 12-month improvements among medium initial scorers in both groups were statistically significantly greater than those observed among high scorers. High scorers in the control group showed a statistically insignificant decrease in condom use self-efficacy between baseline and 12 months (4.64–4.38, $p = .083$). High scorers in the intervention group, however, had a statistically significant increase from baseline to 12 months (4.49–4.80, $p = .010$). The overall trajectory, baseline to 12 months, was statistically significantly greater among intervention youth compared to control youth.

Condom Use Intention

As with the other outcomes examined, low initial scorers (intervention and control) in condom use intention had the greatest increases baseline to 12 months (control: 0.99–3.34, $p < .0001$; intervention: 1.01–3.63, $p < .0001$) (see Fig. 4). Medium scorers in both groups had statistically significant baseline to 12-month improvements (control: 3.20–3.82, $p = .037$; intervention: 3.12–4.07, $p = .001$). Control group youth showed gradual improvement over time, while intervention youth had a large increase post-camp that waned slightly over time. Those in the intervention group had higher, but not significant, scores at 12 months compared with those in control (4.07 vs. 3.82, $p = .473$). High scorers in both groups experienced a statistically significant decline in condom use intention over 12 months, but also maintained the highest condom use intention score at 12 months across all groups (control: 4.53, intervention: 4.50). As observed with other outcomes, baseline to 12-month trajectories differed by baseline levels of the target outcome. Low baseline scorers had statistically significantly greater increases in condom use intention than medium or high baseline scorers across study groups. While medium baseline scorers experienced more modest increases compared to low baseline scorers, they remained significantly higher than high initial scorers.

Partner Negotiation on Condom Use

The largest baseline to 12 month difference was observed among those with the initial low scores (control: 1.24–2.32, $p < .0001$; intervention: 1.24–2.14, $p < .0001$), followed by a smaller increase among medium scorers (control: 2.53–2.96, $p < .0001$, intervention: 2.59–3.02, $p < .0001$) (see Fig. 5). Those whose baseline scores were the highest declined over 12 months, but remained higher than other groups (control: 3.35, intervention: 3.33). While there were no between group differences in partner negotiation skills on condom use over time, baseline to 12-month trajectories did statistically significantly differ by baseline levels of the target outcome. Baseline to 12-month improvements were statistically significantly greater in low baseline scorers compared to medium and high baseline scorers in both study groups. While medium baseline scorers' improvements were smaller than low baseline scorers, the baseline to 12-month trajectories remained statistically significantly better than those in the high initial scoring group across both study groups.

Predictive Factors for Unresponsiveness to RCL Intervention

Regression analyses are presented in Table 2. Results indicate high initial scores in all five outcomes predicted unresponsiveness to the intervention. Medium initial scores in knowledge and condom belief also predicted unresponsiveness to RCL. Youth receiving RCL were protected against being unresponsive on condom belief and condom use self-efficacy; thus, receiving RCL was significantly related to improvement (i.e., responsiveness) on these two outcomes. Being enrolled in school reduced the likelihood of being unresponsive to RCL for HIV prevention/transmission knowledge. No other characteristics of youth were significantly associated with unresponsiveness to RCL.

Table 2 Predictive factors for unresponsiveness to the RCL intervention over 12 months

Variables	Knowledge			Belief condom			Partner negotiation			Condom use self-efficacy			Condom use intention		
	OR	SE	*Z*	OR	SE	*Z*	OR	SE	*Z*	OR	SE	*Z*	OR	SE	*Z*
Estimated models[†]															
Outcome values (baseline)															
Low	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Medium	2.37	0.38	2.25*	2.32	0.41	2.06*	1.67	0.44	1.17	1.61	0.53	0.89	0.93	0.49	−0.15
High	14.12	0.47	5.61***	31.25	0.54	6.35***	21.03	0.50	6.12***	9.00	0.59	3.74***	82.93	0.63	7.00***
Intervention (control = ref)	0.77	0.29	−0.89	0.25	0.41	−3.38***	1.39	0.34	0.97	0.37	0.44	−2.31*	0.44	0.43	−1.89
Age	0.98	0.09	−0.23	1.03	0.11	0.29	0.91	0.11	−0.91	1.00	0.12	0.00	1.08	0.14	0.56
Gender	1.68	0.30	1.74	1.91	0.38	1.72	1.35	0.33	0.89	1.22	0.42	0.47	0.85	0.43	−0.39
In school	0.26	0.68	−2.01*	0.56	0.77	−0.74	0.28	0.67	−1.91	0.55	0.75	−0.80	0.98	0.97	−0.02
Ever skip school	0.57	0.36	−1.55	0.91	0.41	−0.24	0.99	0.40	−0.03	0.72	0.44	−0.75	0.39	0.60	−1.59
Ever suspended	1.08	0.31	0.24	1.14	0.37	0.36	1.07	0.36	0.19	1.17	0.38	0.41	0.91	0.52	−0.19
N			244			241			225			239			241

The data collection instrument, including the collection of sample characteristic data, was based on Stanton et al.'s (1995) Youth Health Risk Behavior Inventory and further refined through feedback gleaned by the tribal–academic partnership during the adaptation of focus on youth into the Respecting the Circle of Life program

*$p < .05$; **$p < .01$; ***$p < .001$

[†]All models were adjusted for self-selected peer group clusters

Discussion

We present results from a comprehensive intervention impact evaluation for the overall sample and predefined subgroups of low, medium, and high initial scorers in: HIV prevention/transmission knowledge, belief condoms prevent infection/pregnancy, condom use self-efficacy, condom use intention, and partner negotiation skills on condom use from youth participating in a trial of the RCL program. Results demonstrated variation of RCL intervention impact according to these predefined subgroups.

The RCL intervention had the greatest impact on youth who were low baseline scorers and little impact on high baseline scorers across outcomes. The largest increases in all five outcomes among low and medium initial scorers occurred at post-camp and 6 months, followed by a slight increase or attenuation at 12 months. Our analyses reveal a pattern among low, medium and high initial scorers: the lowest scorers had the largest improvements, followed by a slightly smaller improvement among medium scorers, and a small decrease among high scorers over 12-months follow-up. Although high initial scorers had slight decreases in some outcome scores over time, most of their scores at 12 months were still higher than those of the low and medium initial scorers at the same time point. While this may reflect some regression to the mean or some type of ceiling effect, improvements among high initial scorers may be less meaningful, given their starting point. Reliability values (Cronbach's alphas) for outcomes that include multiple items combined into scales were examined across study groups for comparability. Alpha values were comparable (consistent with expectations in a randomized controlled trial); therefore, even if there were some regression to the mean, there should be no issue with differential regression between study groups.

The RCL intervention was more effective for improving HIV prevention/transmission knowledge, condom belief, condom use self-efficacy, and condom use intention among low and medium initial scorers. For condom belief and condom use self-efficacy, low initial scorers who received RCL had similar scores to medium initial scorers receiving the control program at 12 months. For these same variables, medium initial scorers receiving RCL had scores equal to or higher than high initial scorers receiving control at 12 months. Thus, RCL was able to increase condom belief and condom use self-efficacy to the level of youth who already had high scores in these outcomes at baseline. Youth receiving the control program did see improvements in measured outcomes, but took 12 months to achieve those gains, in comparison with youth receiving RCL who saw improvements immediately after camp, and which were sustained over time. Increases among the control group were likely developmental and may be attributed to gradual exposure to sexual health messaging from a combination of sources (i.e., peers/friends, siblings, parents, teachers and/or other adults) over the 12-month time frame.

Results of the regression analysis indicate high initial scores on each of the five outcome variables and medium initial scores on knowledge, condom belief and condom use intention significantly predicted unresponsiveness to the RCL intervention. Participants who received RCL were less likely to be unresponsive to condom belief and condom use self-efficacy. Aside from being currently in school, which reduced the likelihood of unresponsiveness to RCL for HIV prevention/transmission knowledge, the participant characteristics of age, gender, skipping school, and suspension from school were not significantly predictive of unresponsiveness to RCL. In other words, our results show participants who were currently in school were more likely to improve their HIV prevention/transmission knowledge, but that participant age, gender, skipping school, and school suspension did not predict who made no improvement in all five outcome variables over the 12-month post-intervention period.

The finding that participants who were currently in school were more likely to improve their HIV prevention/transmission knowledge warrants further discussion. At the time of RCL implementation and evaluation, there was no standardized sexual health education curriculum delivered across schools on the reservation, nor where there any comparable or supplemental community-based programs available. To our knowledge, some schools offered optional sexual health education classes which required parental consent; however, these classes were not offered consistently throughout the academic year, nor at all schools. Perhaps youth who were enrolled in school received information about how HIV and other STIs are transmitted through coursework not solely devoted to sexual health education, such as during biology and/or physical education? The extent to which RCL content may be supplementing and/or complementing information received at school is worth further investigation. Future evaluations of RCL will ask youth directly about their exposure to sexual health education in school during the evaluation period.

Greater responsiveness among participants with low initial scores has been demonstrated in other studies, including the parallel analysis conducted by Wang et al. (2013) of the FOY program from which RCL was adapted. In that study, Wang et al. found that FOY had greater impact on HIV prevention/transmission knowledge, condom use skills, condom use self-efficacy, and condom use intention among low and medium initial scorers, comparable to our analysis. Similarly, in an evaluation of an early childhood home-visiting intervention for pregnant AI adolescent mothers, Barlow et al. (2018) found that 3-year postpartum, intervention response was greatest among children born to mothers entering the trial as

substance users. Greater responsiveness among children of high-risk mothers versus children of low-risk mothers was observed across externalizing, internalizing, and dysregulation behavioral problems (Barlow et al., 2018; Rosenstock, Goklish, Kee, & Barlow, 2016).

Taken together, these results beg the question of whether responsiveness analyses can guide the assessment of youth prior to enrollment to determine who might benefit most from program administration or who might be ready for the next programmatic level targeting outcomes further downstream. Additionally, responsiveness analyses may enable tailoring of interventions so that low, medium and high initial scorers receive slightly different variations of program content which accurately reflect their baseline levels of knowledge, beliefs, attitudes, and skills. Such implementation considerations are particularly relevant for rural, reservation-based communities and other resource-strained settings, with limited enrollment capability. The RCL program is currently undergoing replication with other tribal communities. The information gleaned from this analysis will help guide dissemination efforts that optimize time and resources. Specifically, recommendations will be made to screen youth prior to enrollment and prioritize RCL delivery to subgroups of youth with lower baseline scores on the key outcomes of interest.

Further, this particular analysis detailed attenuating impacts of RCL over time and suggests the importance of follow-on booster session(s), perhaps including parents, to combat waning and reinforce messaging across peer and family networks. Responsiveness analyses may therefore aid in program design and timelines for implementation to reinforce key content and practice learned skills.

Limitations

There are limitations to this study. (1) Categorization of baseline outcomes into subgroups of low, medium and high scorers was subjective, although the cutoffs of 25th, 50th and 75th percentiles are frequently employed, including by Wang et al. (2013). To avoid differential information bias, we included longitudinal trajectories both overall and by subgroup for both the RCL and control groups. (2) Decreases in mean scores on some outcome variables among high initial scorers in both RCL and control groups may reflect regression-to-the-mean given repeated assessments were completed with the same participants. (3) Too few youth in our sample were sexually active (22%), thus this analysis was not powered to detect differences in behavioral outcomes of interest such as condom use, contraceptive use and number of partners. Following youth for a longer period of time, in order to capture such behavioral outcomes of interest is an important next step to this line of research. (4) Measurement ceiling effects (the possibility that a measure does not capture the full range of a construct) may have also played a role for youth who were the initial high scorers.

Conclusions

Our results indicate that the RCL intervention had the greatest longitudinal impact among subgroups with low baseline scores followed by those with medium baseline scores. Further, differences in age, gender and school truancy (skipping/suspension) did not predict responsiveness to the intervention. These results have important public health and prevention science implications: (1) American Indian adolescents with lower initial levels of knowledge, beliefs, self-efficacy, intention, and skills are likely to respond to RCL, and should be the target of program replication and dissemination efforts in order to maximize local capacity and resources. (2) Differentiation of RCL program implementation by baseline levels of target outcomes may improve participants' responsiveness and also suggest development of alternative curriculum content and booster lessons for those with higher baseline scores. (3) Future research should include responsiveness analyses to guide implementation of RCL and other adolescent sexual and reproductive health programs to improve efficacy among specific subgroups, particularly in resource-limited, rural reservation-based settings. (4) RCL is equally likely to impact American Indian youth across different ages, genders and school status, thus validating population-wide implementation in school and other community-based settings.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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