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Crush: A randomized trial to evaluate the impact of a mobile health app on adolescent sexual health

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Abstract

Purpose: Mobile technology allows delivery of sexual and reproductive health (SRH) information directly to youth. We tested the efficacy of Crush, a mobile application aimed at improving sexual health by promoting the use of SRH services and contraception among female adolescents.

Methods: We recruited 1,210 women ages 14 to 18 years through social media advertising and randomized them into a Crush intervention group and a control group that received a wellness app. At 3 and 6 months post-randomization, we compared changes from baseline in behaviors, attitudes, self-efficacy, perceived social norms, birth control knowledge, perceived control and use intentions, and SRH service utilization. Odds ratios were estimated with multivariable logistic regression and adjusted for baseline outcome, age, race/ethnicity, mother's education, and sexual experience.

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Disclaimer:

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

There is no potential conflict of interest

Results: There was no difference in accessing SRH services according to study group. Three months post-baseline, Crush users had higher odds ($p < 0.05$) than control participants of reporting confidence in accessing SRH services (aOR= 1.6, 95% CI: 1.1–2.3) and of believing that it is a good thing to use birth control consistently (aOR= 2.3, 95% CI: 1.4–3.8). Six months post-baseline, Crush users had higher odds than control participants of reporting they can control whether birth control is used every time they have sex (aOR= 1.8, 95% CI: 1.2–2.6) and perceiving they would get pregnant if they did not use birth control (aOR: 1.5, 95% CI: 1.1–2.2). Impacts on other behavioral constructs were also found.

Conclusions: Crush was associated with improvements in knowledge, attitudes and self-efficacy related to key SRH behaviors and may be a strategy to deliver SRH education to adolescent women. Studies including larger numbers of sexually active adolescents are needed to demonstrate behavioral impacts.

Keywords

Teen pregnancy prevention; mobile app; sexual health; technology

Introduction

Despite sustained decreases in adolescent birth rates in the U.S. in recent years, rates remain higher than in other high-income countries; in addition, persistent gaps remain between White, Black, and Hispanic adolescents. In 2017, while the average national birth rate for white adolescent women in the U.S. was 11.4 per 100,000, the birth rates for their Black and Hispanic adolescent peers were markedly higher, 25.8 and 25.3, respectively.¹ In addition to higher rates of pregnancy, Black and Hispanic adolescents also experience higher rates of sexually transmitted infections (STIs) compared with white adolescents in the U.S.^{1,2} According to the Centers for Disease Control and Prevention (CDC), chlamydia and gonorrhea rates for females ages 15–19 years have been increasing from 2014 to 2019.^{1,2}

Historically, school-based sexual health classes aimed to increase students' knowledge and self-efficacy on prevention of unintended pregnancies and STIs.^{3,4,5} However, given the ubiquitous presence of mobile technology, youth have been turning to their phones in search of information, including sexual health information privately.^{6,7,8} Mobile applications have increased youth's access to health content through trackers, geolocation of health services, and health resources.⁹ Among youth across all racial/ethnic groups, over 93% own or have access to smartphones, and 45% report being online on a near-constant basis.⁹ Use of internet-enabled smartphone technology provides an unprecedented and low-cost opportunity to disseminate health messages on a large scale.³

Mobile apps have emerged as convenient and efficient strategies to deliver behavior modification interventions on diverse health topics, such as healthy eating,^{10,11} fitness,^{10,11} smoking cessation,^{10,11} sun protection,^{11, 12} and mental health.^{10,11} Mobile-based interventions are generally well accepted by users and feasible for administering health interventions.¹³ Many are demonstrably effective in reducing health risk behaviors and improving health outcomes.¹¹

Over a decade ago Sexinfo texting service successfully pioneered the use of text messaging to deliver high quality sexual health information to youth.¹⁴ More recently, mobile applications have been launched with the same objective but using multiple formats to deliver the information through videos, quizzes, and interactive text.^{15, 16, 17} Apps such as Bedsider¹⁵, miPlan¹⁸, Salud-I Tú¹⁶, and Seventeen Days¹⁷, have been evaluated and have shown promising evidence for the ability of web-based or mobile tools to promote use of more effective methods of birth control¹⁵ and increase the uptake of long-acting reversible contraception (LARC).¹⁹ However, all of these apps focus only on birth control use or are implemented in a clinic in preparation for a contraception consult.^{17,18} In fact, in a 2018 review of sexual health apps, researchers found that only 1% of evaluated apps included comprehensive sexual health information.²⁰

We conducted a randomized controlled trial to evaluate the efficacy of “Crush”, a comprehensive and medically-accurate web-based mobile application aimed at improving sexual health by increasing use of more effective contraceptive methods (i.e., hormonal methods, intrauterine device) and utilization of sexual and reproductive health services (SRH) among adolescent women and to evaluate its effect on constructs related to these behaviors.

Methods

Study Design

This study is a longitudinal, two-arm randomized controlled trial of adolescent women, ages 14–18 years, residing in the United States. Participants were recruited online through social media paid advertisements during a three-month enrollment period. Participants randomized to the intervention group were given unlimited access to Crush. Participants assigned to the control condition were directed to an existing free nutrition and physical fitness application designed for adolescent women. All participants received multimedia messages (MMS) to their mobile phones every three days for 6 months to enhance retention during the study period. MMS contained study-related information, motivational messages, content boosters, and reminders to use their assigned digital tool. Participants completed online surveys at baseline, three months, and six months of follow-up, and retained access to either app for the entire 6 month duration of the study. Participants were financially compensated for completion of surveys, receiving, respectively, \$10, \$10, and \$15 gift cards after each survey, and an inspirational bracelet upon enrollment. This study and the formative research were both approved by Solutions IRB (Yarnell, AZ), a private ethics review board.

Sample Recruitment and Enrollment

We digitally recruited young women, ages 14 to 18 years, from across the United States, by advertising on Instagram and Facebook, between November 2016 and January 2017. Banner ads invited women to participate in a study to test a health application. Individuals initially accessed a website screening them for eligibility and enrolling them into the study if they were eligible and interested. To be eligible for the study, participants had to be English-speaking females between 14 and 18 years old, not pregnant, and living in the contiguous United States. Upon completing the enrollment and baseline survey, participants were

randomized using a computer-generated randomization algorithm and gained immediate access to their corresponding intervention.

Eligible participants consented by reading and digitally signing a consent form. To enhance youth responses and protect their privacy, no parental consent was required, consistent with recommendations from national entities.^{22,23}

Intervention description

We developed a youth-informed SRH tool (Crush) that is medically-accurate, grounded in behavior change theory, and relevant and appealing to end users. We engaged 113 youth in our formative process to identify relevant content and branding, test writing level in English and in Spanish, and assess the tool's usability and satisfaction with end users. The Spanish version of the application was not tested. Development and evaluation of this app was supported by the Centers for Disease Control and Prevention through Small Business Innovation Research funding.

The result was “Crush”—a self-led smartphone intervention that disseminates bilingual (English and Spanish) sexual and reproductive health information directly to adolescent women. Crush delivers content on contraception methods, STIs, health clinic navigation, healthy relationships, and pregnancy information through multi-media features, including animations, videos, audio dialogues, comic stories, graphics, and quizzes, to enhance interaction and support various types of learners (Figure 1). The content was reviewed for scientific accuracy by CDC subject matter experts. Its health messages are grounded in the Theory of Planned Behavior (TPB),²⁴ self-efficacy, and vicarious learning, a key behavior change concept in Social Cognitive Theory.²⁵ TPB plus self-efficacy is one of the most popular theoretical models used in current sexual health programs and in most mobile health (mHealth) interventions.²⁶

Outcome Measures

The primary outcome for this analysis was to assess the efficacy of Crush in influencing behavior and behavioral constructs related to use of contraceptive methods for pregnancy prevention and use of sexual and reproductive health service clinics.

Demographic measures and participants' characteristics collected during enrollment included *age* in years (14, 15, 16, 17, 18), *grade in school* (8, 9, 10, 11, 12, completed high school, other), *race and ethnicity* (collapsed into non-Hispanic white, non-Hispanic Black, non-Hispanic other, Hispanic), and *mother's education* (collapsed into high school graduate or less, some college, college graduate). Other participant characteristics collected were related to *sexual orientation* (heterosexual, gay, lesbian, bisexual, queer, questioning, not sure), *ever had vaginal sex* (yes, no), *age at first sex* in years and *ever visited a clinic for SRH services* (yes, no).

Clinic utilization, measured as a dichotomous yes/no variable, was defined as whether participants had attended a clinic for SRH services during the previous three months, regardless of whether participants were sexually active. Clinic utilization attitudes, norms,

self-efficacy, and behavioral intentions were measured with single items on a five-point Likert scale. Attitude items included “Going to a health clinic for sexual and reproductive health services is hard,” and “Going to a health clinic for sexual and reproductive health services is expensive.” Norms were assessed by assessing participants’ agreement or not to the statement: “Most girls my age go to a health clinic for sexual and reproductive health services.” Self-efficacy was assessed by assessing participants’ agreement with the statement “I am confident that I can go to a health clinic for sexual and reproductive health services.” Behavioral intention was assessed by assessing participants’ agreement with the statement “I plan to visit a health clinic the next time I need any sexual or reproductive health services.”

Contraception *use* was assessed by asking about the type of contraception used at last sexual intercourse. In this analysis, only use of hormonal methods (contraceptive pills, shot, patch, ring, and implant) and copper and hormonal intrauterine devices (IUD) were included for the measure of contraception use at last intercourse because we were primarily interested in assessing effects of Crush on utilization of the more effective contraceptive methods. Contraception *attitudes* were assessed with the items, “In general, birth control is too much of a hassle to use,” “In general, it is a good thing to use birth control every time I have sex,” “The IUD and the implant can make me infertile”, and “The IUD and the implant are only for older women.” *Norms* were assessed with “Most girls my age use birth control when they have sex.” *Perceived behavioral control* was assessed with “I have control whether birth control is used every time I have sex.” *Self-efficacy* was assessed with “I am confident that I can use birth control every time I have sex.” *Behavioral intentions* was assessed with “If I have sex in the next 3 months, I intend to use birth control every time I have sex.” We also measured *risk assessment* with the item “If I have sex and do not use any birth control, it is likely that I will get pregnant.”

All outcomes were collected at baseline and follow-up. All negative phrased items were reverse coded where the agree end of the scale represents the favorable outcome. All scaled items were recoded into dichotomous variables for the logistic regression model where the “agree” and “strongly agree” represent presence of the favorable outcome, and “neither agree/disagree”, “disagree”, and “strongly disagree” represent the lack of favorable outcome.

All variables were self-reported.

Statistical Analyses

We assessed frequencies and percentages of all demographic and other participants’ characteristics at baseline (Table 1). We used a multivariable logistic regression model to estimate odds ratios and 95% confidence intervals (95% CIs) for the association between study arm and outcomes separately for three-month and six-month follow-up period, adjusting for the following potential confounding variables: baseline value of the outcome, race/ethnicity, age, mother’s education, ever had sex, and ever visited a clinic for SRH services. For all analyses the outcomes were dichotomous. The study arm and all other independent variables were categorical. Statistical significance of adjusted odds ratios was assessed using the Wald Chi-Square statistic. All analyses were conducted using SAS® 9.4 (Cary, NC).

Results

Final study sample

A total of 1,667 adolescent women were initially recruited and attempted to enroll in the study. We removed participants who were either duplicates or ineligible—(n=103), and those who did not complete enrollment or baseline surveys (n=207). We identified duplicates after comparing demographic and contact information (name, last name, mailing address, and phone number). Ineligible persons were identified by comparing their self-reported date of birth at each survey wave to the birth date entered at enrollment. We enrolled 1,367 women into our sample, but removed 147 participants who at any point requested to be removed from the study; 65 from the intervention group and 82 from the control group. We thus had a final analytic sample of 1,210 women (intervention n= 595, and control n=615). A total of 795 participants completed the 3-month survey (372 from the intervention group and 423 from the control group) and 776 completed the 6-month survey (389 from the intervention group and 387 from the control group) (Figure 2). We experienced slight attrition at each wave of data collection, but we achieved a retention rate of 65% in the intervention group and 63% in the control group at 6 months.

Participant Characteristics

The sample was predominantly 15 to 17-year-old adolescent women (76.9%). Half (52.1%) were non-Hispanic White, while 20.6% self-reported as Hispanic, and 10.9% were non-Hispanic Black. Most (70.5%) had mothers with at least some college education, and over half had mothers with a college diploma (52.1%). Although most participants self-identified as heterosexual (62%), a considerable portion (32.1%) considered themselves either lesbian, gay, bisexual, queer, or questioning. Less than a quarter (22.6%) of participants had ever visited a clinic for SRH services, and 74.3% reported never having had sexual intercourse. Among the 25.7% reporting ever having vaginal sex, the mean age of sexual debut was 15.1 years. There were no significant differences in the distribution of any of the demographic and other participants' baseline variables between the two study arms (Table 1).

Effects of the intervention at 3 and 6 months

We investigated the effects of randomization to the Crush mobile app arm on use of more effective contraception and utilization of clinics for SRH services at the three- and six-month follow-up visits using multivariable logistic regression adjusting for baseline value of the outcome, age, race, mother's education, and previous sexual experience (Tables 2 and 3). We did not find a significant difference in the use of hormonal methods or IUD by the intervention group compared to the control at 3-months or at 6 months. We also did not see a significant difference in the use of SRH services, but the results approximated statistical significance at 3 months of follow-up (aOR= 1.6, CI: 1.0–2.6, p= 0.05). However, we observed significant differences in some behavioral variables. Compared to the control group, at three months post-baseline, Crush participants had higher odds of reporting feeling confident in going to a clinic for SRH services (aOR=1.6, CI: 1.1–2.3, p= 0.01). Likewise, women exposed to Crush had higher odds of believing that it is a good thing to use contraception every time they have sex, compared to women in the control group (aOR= 2.3, CI: 1.4–3.8, p< 0.01). (Table 2)

At six-months post baseline, Crush participants had higher odds of disagreeing with a statement that the IUD and implant can make them infertile, compared with control participants (aOR= 1.5, CI: 1.1–2.0, p=0.02). Additionally, they had higher odds of reporting that they can control whether contraception is used every time they have sex (aOR= 1.8, CI: 1.2–2.6, p<0.01). They also exhibited higher odds of perceiving the risk of pregnancy if contraception is not used, compared with participants in the control arm (aOR= 1.5, CI: 1.1–2.2, p=0.01) (Table 3).

Discussion

Crush intervention is novel in its approach, using a comprehensive, adolescent-focused, and interactive web-based application, as well as in its design, using the internet and social media for recruitment. This is one of few studies to demonstrate that self-led mobile-based interventions can have positive effects in developing confidence in adolescent women to use SRH services and in changing key attitudes and beliefs about contraception.^{15,19} These findings are consistent with texting interventions that promoted clinic utilization for STI testing and treatment adherence.²⁷ Our results suggest that Crush may support adolescent women as they make important decisions about their sexual and reproductive health by promoting positive attitudes and confidence in using contraception, even before they become sexually active. In fact, Pulse, an evidence-based and self-led mobile app for older adolescents and young adults ages 18–24, was also found effective in promoting birth control use, but its content goes further and includes information about healthy relationships, pleasure, STIs, and navigation of clinical services²¹. Pulse emerged as an adaptation of Crush that was specifically designed for older adolescents and young adult women who are sexually active²¹.

We did not find significant impact on the primary behavioral outcomes (contraceptive method use). However, we found a small increase in clinic visitation at 3-months, with the result approaching statistical significance. The lack of significance may be explained by the fact that most participants were between 15 and 16 years of age, and over 70% self-reported never having had vaginal sex at baseline, which is slightly higher than the national average of 62.3% for female high school students.²⁸ The relatively small sample of sexually active participants limits our ability to detect changes in contraception use or use of SRH services during the study period. As we were not able to evaluate extent of engagement with the app, we also cannot exclude the possibility that the degree of engagement was not high enough to result in effects on behavior.

However, we were able to demonstrate that Crush had a significant effect at 3 months on the adolescents' level of confidence in going to a health clinic for SRH services. Crush participants also experienced greater levels of perceived behavioral control over contraception use at 6 months. Crush also enhanced adolescent women's positive attitudes toward using contraception at 3 months and had a positive impact at 6 months on their knowledge about IUDs and implants and the perception of pregnancy risk associated with not using contraception.

Crush's content was anchored in the Theory of Planned Behavior, which is the most widely used theory in effective mobile apps in other health fields.¹¹ We speculate that the age-specific, tailored, engaging presentation and the diversity of media formats in which the content was delivered were important in leading to the observed differences at 3- and 6-months between the Crush and control respondents. Future evolution of Crush could consider additional interactive features and new content to engage users and promote continued use of the app.

Our study is subject to several limitations. First, most of the sample self-report never having had sex, which limited our ability to test behavior change regarding contraception use or the utilization of clinics for SRH services. The study was also not designed to assess dual protection use, an important strategy in the prevention of STIs and unintended pregnancy. The sample was self-selected by responding to social media banner ads. Social media algorithms select the individuals who were exposed to our recruitment ads. This may have resulted in selection bias. Over half of the sample was white and most had highly educated mothers with at least some college education. Participants who are willing or able to participate in this type of study may come from families with greater social capital, which in turn may have positive impact on their sexual health decisions. Given the online-only trial design, we anticipated challenges in confirming true and unduplicated participants in the sample. We took careful steps to manually identify and remove duplicate participants. However, it is possible that some participants responded in such a way to appear eligible when they actually were not. Additionally, recruiting and conducting online trials is challenging due to usually high rates of attrition,²⁹ and our study was no exception. On average, 35% of participants were lost to follow-up at the three- and six-month surveys; however this is typical or better than the average 53% attrition for online studies,²⁹ and there was no statistically significant difference in study arm, demographic factors, previous sexual experience or sexual intentions at baseline by follow-up status. It is possible that the inclusion of those lost to follow-up, were their outcomes known, would reduce the magnitude of the intervention's estimated effects. Higher monetary incentives may be useful in motivating enrollment and retention in future studies. Moreover, we did not assess whether participants who were lost to follow-up stopped using Crush or whether study outcomes were related to extent of exposure and engagement with the app. Future studies should consider analyzing user data to further assess the mechanisms of the effects as well as subgroup differences in exposure or effect of the intervention. All data are self-reported, and as such are subject to reporting biases. Future studies could benefit by linking participants to clinics and accessing clinic records to provide an objective and quantitative measure confirming attendance and utilization of services. Another study limitation was the relatively short duration of follow-up.

In summary, our study findings are encouraging, as they demonstrate the potential of a mobile-based sexual and reproductive health application to improve adolescent women's confidence around visiting health clinics for SRH services, and attitudes, knowledge, and perception of control regarding use of contraception, even before they become sexually active. The high level of smartphone ownership by youth offers an opportunity to reach them in a way that is private, relevant, and time-sensitive. As observed in the study of Pulse, a web-based app based on Crush but tailored to older adolescents, digital tools may help

bridge the gap of sexual and reproductive health education by providing information and resources to young women both in and outside of traditional systems of learning. Likewise, the use of Crush in clinical settings could be helpful, as evidence has shown that other apps like Salud-i Tú or Seventeen Days were effective when suggested by clinical staff. Future studies recruiting through social media can develop further strategies to attract racial and ethnic minorities. More information is also needed on how to retain users for a longer period of time, and whether brief mobile interventions may be as effective as lengthier mobile interventions. Future research can also examine longer-term effects of the intervention, and what components of the intervention and levels of exposure (dose-response) are necessary to achieve behavior change and optimize effectiveness.

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Abbreviations:

CDC	Centers for Disease Control and Prevention
IUD	intra-uterine device
LARCs	long-acting reversible contraception
MMS	multimedia messages
SRH	sexual and reproductive health services
STIs	sexually transmitted infections

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Impact and Contribution

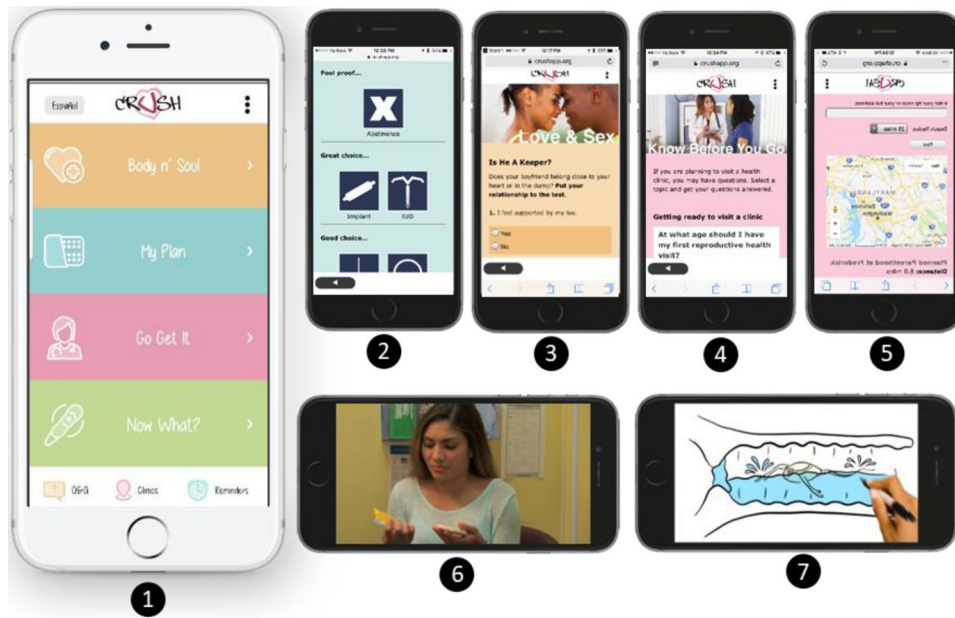
This innovative internet-based randomized control study demonstrated the potential of a mobile-based sexual and reproductive health application to improve adolescent women’s confidence around visiting health clinics for SRH services, and attitudes, knowledge, and perception of control regarding use of birth control.

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Crush pages: 1) landing page, 2) birth control information, 3) healthy relationship assessment, 4) clinic visit FQA, 5) clinic locator, 6) video on birth control, 7) whiteboard animation on pregnancy physiology.

Figure 1.
Crush landing page and content examples.

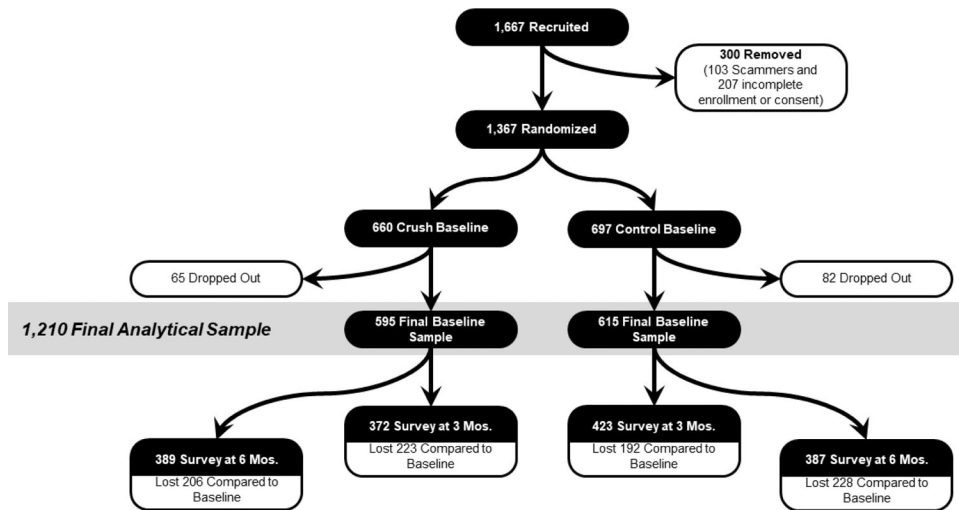


Figure 2.
CONSORT Diagram of Participant Recruitment for the Clinical Trial of “Crush” Smartphone App.

Table 1

Demographic and other Baseline Characteristics of Participants at Baseline (n=1,210).

Participant Characteristics	Intervention		Control		Total	
	N	%	N	%	N	%
Age (years), n (%)						
14	104	(17.5)	112	(18.2)	216	(17.9)
15	142	(23.9)	142	(23.1)	284	(23.5)
16	163	(27.4)	177	(28.8)	340	(28.1)
17	159	(26.7)	148	(24.1)	307	(25.4)
18	27	(4.5)	36	(5.9)	63	(5.2)
Grade in school, n (%)						
7 th	3	(0.5)	3	(0.5)	6	(0.5)
8 th	21	(3.5)	28	(4.6)	49	(4.0)
9 th	123	(20.7)	123	(20.0)	246	(20.3)
10 th	153	(25.7)	146	(23.7)	299	(24.7)
11 th	154	(25.9)	178	(28.9)	332	(27.4)
12 th	130	(21.8)	115	(18.7)	245	(20.2)
Completed high school or equivalent	8	(1.3)	16	(2.6)	24	(2.0)
Other	3	(0.5)	6	(1.0)	9	(0.7)
Race/Ethnicity, n (%)						
Hispanic	124	(22.3)	125	(21.3)	249	(20.6)
Non-Hispanic White	301	(54.1)	329	(56.1)	630	(52.1)
Non-Hispanic Black	71	(12.8)	61	(10.4)	132	(10.9)
Non-Hispanic Other	60	(10.8)	71	(12.1)	131	(10.8)
Mother's Education, n (%)						
High School Graduate or less	141	(25.3)	133	(23.4)	274	(22.6)
Some College	114	(20.4)	109	(19.2)	223	(18.4)
College Graduate	303	(54.3)	327	(57.5)	630	(52.1)
Sexual Orientation, n (%)						
Heterosexual (straight)	363	(61.0)	387	(62.9)	750	(62.0)
LGBTQ	203	(34.1)	185	(30.2)	388	(32.1)
Lesbian/Gay	19	(3.2)	10	(1.7)	29	(2.4)
Bisexual	132	(22.2)	111	(18.0)	243	(20.1)
Questioning	34	(5.7)	36	(5.9)	70	(5.8)
Queer	18	(3.0)	28	(4.6)	46	(3.8)
Not Sure	29	(4.9)	43	(7.0)	72	(6.0)
Ever had vaginal sex (yes), n (%)	154	(25.9)	157	(25.6)	311	(25.7)
Age of first sex (among sexually active)-(years), mean (standard deviations)	15.2	(SD= 1.35)	15.1	(SD= 1.23)	15.1	(SD=1.27)
Ever visited a clinic for SRH services (yes)	130	(21.8)	144	(23.5)	274	(22.6)

* NH refers to non-Hispanic ethnicity; SRH: Sexual and Reproductive Health.

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Table 2

Multivariable associations between study arms and outcomes adjusting for confounding variables at 3-month follow-up (n=795).

	Crush %	Control %	aOR ⁱ	95% CI ⁱⁱ	P-value
Clinic use					
Behavior					
Visited a clinic in last 3 months for SRH services.	15.8	13.1	1.6	1.0–2.6	0.05
Intentions					
I plan to visit a health clinic the next time I need SRH ⁱⁱⁱ services. (SA/A) ^{iv}	74.7	72.4	1.1	0.8–1.7	0.46
Attitudes					
Going to a health clinic for SRH services is hard (RC ^v). (SD/D/N) ^{vj}	33.5	32.1	0.9	0.6–1.3	0.61
Going to a health clinic for SRH services is expensive (RC). (SD/D/N)	28.5	26.3	0.8	0.6–1.2	0.36
Social norms					
Most girls my age go to a health clinic for SRH services. (SA/A)	39.5	35.9	1.2	0.9–1.7	0.31
Self-efficacy					
I am confident that I can go to a health clinic for SRH services. (SA/A)	76.3	69.2	1.6	1.1–2.3	0.01
Birth Control Use					
Behavior					
Use of any hormonal methods or IUD (intra uterine device) ^{vii} at last sex among sexually active sample.	10.5	12.3	0.9	0.4–1.8	0.67
Engagement in unprotected sex at last sex. ^{viii}	4.6	3.4	1.4	0.7–2.9	0.38
Intentions					
If I have sex in the next 3 months, I intend to use birth control every time I have sex. (SA/A)	83.7	79.1	1.1	0.7–1.7	0.65
Condom intentions in next 3 months. (VL/L) ^{ix}	87.4	89.5	0.8	0.5–1.4	0.50
Pills intentions in next 3 months. (VL/L)	46.1	47.3	1.2	0.8–1.7	0.33
Shot intentions in next 3 months. (VL/L)	6.0	6.9	0.6	0.3–1.4	0.26
Patch intentions in next 3 months. (VL/L)	3.7	4.2	0.6	0.2–1.5	0.29
Ring intentions in next 3 months. (VL/L)	2.9	2.3	1.2	0.4–3.7	0.72
IUD intentions in next 3 months. (VL/L)	6.5	6.0	0.7	0.3–1.7	0.44
Implant intentions in next months. (VL/L)	6.8	7.0	0.9	0.4–2.1	0.74
Attitudes					
In general, birth control is too much of a hassle to use. (SD/D/N)	72.1	73.1	0.8	0.6–1.2	0.29
In general, it is a good thing to use birth control every time I have sex. (SA/A)	89.0	82.1	2.3	1.4–3.8	0.00
Social norms					
Most girls my age use birth control when they have sex. (SA/A)	58.2	51.5	1.1	0.8–1.6	0.53
Control perception					
I have control whether birth control is used every time I have sex. (SA/A)	76.4	71.1	1.3	0.9–1.8	0.24
Self-efficacy					
I am confident that I can use birth control every time I have sex. (SA/A)	81.8	73.4	1.3	0.9–2.0	0.21

	Crush %	Control %	aOR ⁱ	95% CI ⁱⁱ	P-value
Knowledge					
The IUD and the implant are only for older women (RC). (SD/D/N)	56.6	52.1	1.3	0.9–1.9	0.12
The IUD and the implant can make me infertile (RC). (SD/D/N)	51.4	42.3	1.4	1.0–2.0	0.07
If I have sex and do not use any birth control, it is likely that I will get pregnant. (SA/A)	64.8	60.3	1.1	0.3–1.5	0.64

ⁱ aOR: Odds ratios adjusted for baseline value of the outcome, age, race, mother's education, ever had sex, ever visited a clinic for SRH services

ⁱⁱ CI: Confidence interval

ⁱⁱⁱ SRH: Sexual and reproductive health

^{iv} SA/A: Strongly agree and Agree categories collapsed

^v RC: Reverse coded

^{vi} SD/D/N: Strongly disagree, disagree and neither agree/disagree categories collapsed (apply only to reverse coded items)

^{vii} includes both copper and hormonal IUDs

^{viii} Unprotected sex: No use of any method (hormonal, IUD, or condom)

^{ix} VL/L: Very likely and Likely categories collapsed

Table 3

Multivariable associations between study arm and outcomes adjusting for confounding variables at 6-month follow-up (n=776).

	Crush %	Control %	aOR ⁱ	95% CI ⁱⁱ	P-value
Clinic use					
Behavior					
Visited a clinic in last 3 months for SRH services.	13.3	15.8	0.8	0.5–1.3	0.35
Intentions					
I plan to visit a health clinic the next time I need SRH ⁱⁱⁱ services. (SA/A) ^{iv}	78.1	73.8	1.9	0.8–1.6	0.65
Attitudes					
Going to a health clinic for SRH services is hard (RC ^v). (SD/D/N) ^{vi}	40.7	32.9	1.4	1.0–2.0	0.06
Going to a health clinic for SRH services is expensive (RC). (SD/D/N)	29.9	25.9	1.3	0.9–1.9	0.13
Social norms					
Most girls my age go to a health clinic for SRH services. (SA/A)	42.3	37.2	1.2	0.8–1.7	0.40
Self-efficacy					
I am confident that I can go to a health clinic for SRH services. (SA/A)	81.1	75.7	1.4	0.9–2.1	0.09
Birth Control Use					
Behavior					
Use of any hormonal methods or IUD (intra uterine device) ^{vii} at last sex among sexually active sample.	12.3	12.9	0.7	0.3–1.6	0.37
Engagement in unprotected sex at last sex. ^{viii}	4.5	4.7	0.9	0.5–1.9	0.87
Intentions					
If I have sex in the next 3 months, I intend to use birth control every time I have sex. (SA/A)	84.3	83.0	1.0	0.6–1.5	0.85
Condom intentions in next 3 months. (VL/L) ^{ix}	90.6	86.5	1.6	0.9–2.8	0.09
Pills intentions in next 3 months. (VL/L)	43.2	49.9	0.9	0.6–1.3	0.51
Shot intentions in next 3 months. (VL/L)	5.9	6.8	0.9	0.5–1.9	0.82
Patch intentions in next 3 months. (VL/L)	3.8	5.1	0.6	0.3–1.5	0.28
Ring intentions in next 3 months. (VL/L)	2.7	3.8	1.0	0.4–2.8	0.94
IUD intentions in next 3 months. (VL/L)	8.3	7.4	1.3	0.7–2.5	0.45
Implant intentions in next months. (VL/L)	9.2	7.8	1.6	0.8–3.1	0.16
Attitudes					
In general, birth control is too much of a hassle to use. (SD/D/N)	71.7	69.6	1.0	0.7–1.5	0.99
In general, it is a good thing to use birth control every time I have sex. (SA/A)	87.6	85.5	1.4	0.9–2.2	0.20
Social norms					
Most girls my age use birth control when they have sex. (SA/A)	55.5	54.9	1.0	0.7–1.3	0.74
Control perception					
I have control whether birth control is used every time I have sex. (SA/A)	80.6	71.4	1.8	1.2–2.6	0.00
Self-efficacy					
I am confident that I can use birth control every time I have sex. (SA/A)	82.6	79.1	1.1	0.7–1.7	0.65

	Crush %	Control %	aOR ⁱ	95% CI ⁱⁱ	P-value
Knowledge					
The IUD and the implant are only for older women (RC). (SD/D/N)	59.9	57.5	1.3	0.9–1.8	0.19
The IUD and the implant can make me infertile (RC). (SD/D/N)	50.5	42.7	1.5	1.1–2.1	0.02
If I have sex and do not use any birth control, it is likely that I will get pregnant. (SA/A)	70.5	61.1	1.5	1.1–2.2	0.01

ⁱ aOR: Odds ratios adjusted for baseline value of the outcome, age, race, mother's education, ever had sex and ever visited a clinic for SRH services.

ⁱⁱ CI: Confidence interval

ⁱⁱⁱ SRH: Sexual and reproductive health

^{iv} SA/A: Strongly agree and Agree categories collapsed

^v RC: Reverse coded

^{vi} SD/D/N: SD/N: Strongly disagree, disagree and neither agree categories collapsed.

^{vii} includes both copper and hormonal IUDs

^{viii} Unprotected sex: No use of any method (hormonal, IUD, or condom)

^{ix} VL/L: Very likely and Likely categories collapsed