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Original Research Article

Improving contraceptive use among Latina adolescents: A cluster-randomized controlled trial evaluating an mHealth application, *Health-E You/Salud iTu*

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ABSTRACT

Objective: To evaluate the effectiveness of *Health-E You/Salud iTu*, a mobile health application (app), on increasing knowledge, self-efficacy and contraception use among Latina adolescents, its impact on visit quality, and app satisfaction.
Study Design: This study used cluster-randomized controlled trial (CRCT) of 18 school-based health centers (SBHCs). Prior to the visit, intervention participants received the patient-centered contraceptive decision-making support app and controls answered sexual health questions on iPads. Participants completed a previsit questionnaire and 3 follow-up surveys (48 hours, 3-, and 6-months) after the recruitment visit (where intervention participants completed the app). Differences in adolescents' contraceptive knowledge, self-efficacy, and use over the 6-month follow-up were assessed by generalized mixed effects regression models.
Results: A total of 1,360 Latina adolescents participated; 57.2% responded to the 48-hour survey, 50.1% to the 3-month, 49.7% to the 6-month, and 42.3% to both the 3- and 6-month surveys. *Health-E You* users' demonstrated significant increases in pre-post knowledge ($p < 0.001$). Intervention participants who completed the follow-up survey reported greater increases in mean self-efficacy from baseline (23.2 intervention vs. 22.5 controls) to 6 months (26.1 vs. 23.4; b = 1.58, 95% CI 0.38–2.77, $p = 0.01$), and greater increases in non-barrier contraceptive use from baseline (29% intervention vs. 30% controls) to 3 months (63% vs. 45%; OR = 3.29, 95% CI 1.04–10.36, $p = 0.04$) and 6 months (63% vs. 44%; OR = 5.54, 95% CI 1.70–18.06, p = 0.005). Providers and adolescents reported high app satisfaction and stated it improved visit quality.
Conclusions: While data suggest that *Health-E You* improved outcomes, findings must be interpreted cautiously. Intervention participants had higher baseline sexual activity rates, more recruitment visits for pregnancy testing, emergency contraception or birth control, and lower completion rates of follow-up surveys than controls.
Implications: Despite declines in adolescent pregnancy in the United States, Latinas continue to have disproportionately high rates compared to white females. The *Health-E You* app may be an effective support tool for both adolescents and providers in SBHCs, and possibly other clinical settings, across the country to increase contraceptive use and thereby decrease unintended pregnancies. It could potentially reduce disparities in adolescent pregnancies and create more efficient visit time spent between clients and their providers.

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1. Introduction

Despite dramatic declines in adolescent pregnancy rates in the United States (U.S.), they remain higher than all other industrialized nations [1]. Most adolescent pregnancies are unintended and Hispanic[1] adolescents have disproportionately high rates [2]. They tend to have less knowledge of and are less likely to use contraception than non-Hispanics [3,4] and use condoms inconsistently [5,6]. Hispanic women utilize reproductive health services less frequently than other groups [7] and many express discomfort discussing sexual health and/or fear their information will not be kept confidential [8].

Computer-based interventions can improve reproductive health care by tailoring health messaging [9], improving adolescents' disclosure of sexual behaviors [10,11], and are highly acceptable among Hispanic adults and adolescents [**Error! Bookmark not defined.**,12–15]. However, evidence for computer-based contraceptive interventions is limited with only a few randomized control trials (RCTs) [16–20], often conducted in family planning clinics with no or small samples of Latina adolescents. Studies demonstrated short-term improvements in knowledge [18,20], method choice [19], and enhanced counseling and decision-making [20], but not use of contraception. To address this gap, we developed *Health-E You/ Salud iTu* an interactive mobile application (app), in English and Spanish, to provide patient-centered contraceptive decision-making support and improve contraceptive use among sexually active Latina adolescents [21,22].

2. Methods

2.1. Design

Using a cluster-RCT of 18 school-based health centers (SBHCs), this study evaluated *Health-E You's* effect on knowledge, self-efficacy, use of effective contraception over time, and effectiveness and efficiency of the clinical encounter. SBHCs came from Los Angeles County (the second largest school district), in areas of high need and serve large populations of Latinx adolescents [23]. Clinics were randomized to the control ($n = 9$) or intervention group ($n = 9$) using computer-generated random assignment.

2.2. Recruitment

All adolescent girls were offered an iPad Air upon clinic check-in (between August 2016 and May 2018). The "user" selected their preferred language and completed an online survey that obtained consent and assessed eligibility (i.e. female; 14 to 18 years; Hispanic/Latina[2]; sexually active; not currently pregnant; and not currently using long-acting reversible contraception (LARC)). While waiting to see their provider, intervention participants completed *Health-E You* and controls responded to the baseline survey on the iPad. Participants received text and/or email reminders with links to complete 3 follow-up surveys: 48 hours, 3 months, and 6 months after the recruitment visit. Follow-up surveys did not involve further use of the app or clinic visits. The app also screened for prior study participation and excluded participants who made another clinic visit prior to completing the final follow-up assessment.[3] Participants received a gift card for completing each survey and a bonus for completing all surveys, for a $70 maximum. This study received Institutional Review Board approval and is registered with ClinicalTrials.gov, #NCT02847858.

2.3. Intervention

Health-E You, described elsewhere [21,22], begins with a contraceptive knowledge assessment in the form of a "Myth-Buster's" game. It then asks about attitudes and experiences that are important when selecting contraception. Based on those responses, the app provides "top choice" contraception recommendation(s) grouped by tiers of effectiveness [24]. The user can learn more about recommended methods and/or any other method of their choice (via brief descriptions and video vignettes). Upon completion, the user is asked to select the method(s) they are most interested in using and, with user consent, sends information (i.e., the method(s) interested in using, app recommendation(s), and potential contraindications) to a wireless printer for the provider to review prior to the face-to-face encounter. The app concludes with a post-knowledge assessment, messaging to use condoms and information about emergency contraception (EC).

2.4. Outcome measures

2.4.1. Knowledge

Was asked in the baseline surveys and upon completing *Health-E You*. The seven myth/fact items were developed by the research team with input from adolescents: (1) Birth control pills (BCPs) do not reduce the risk of getting an STI (fact); (2) As long as the male partner pulls out before he ejaculates (cums), the female will not get pregnant (myth); (3) Weight gain is a common side effect of most birth control methods, especially for the IUD (myth); (4) BCPs begin working as soon as you start taking them (myth); (5) Decreased menstrual bleeding from using IUDs does not cause health problems later on (fact); (6) Long-acting contraception methods, like the IUD and implant, can make it more difficult to become pregnant in the future (myth); (7) The IUD is easy for a medical provider to insert and remove (fact). The scale score is the count of correct answers.

2.4.2. Self-efficacy

Was assessed at each time point with three items developed by the research team: "How confident are you that you can: (1) "talk to your doctor about what birth control method(s) to use?" (2) "use birth control correctly so you do not get pregnant?" and (3) "have the information you need to choose the most appropriate birth control method for you?" Responses ranged from 0 = not at all confident to 10 = completely confident (total score range = 0–30; Cronbach's alpha range = 0.74-0.80).

2.4.3. Contraceptive use

Was reported over the prior 3 months at baseline, 3- and 6-month follow-ups. Use was dichotomized into non-barrier methods versus condoms/nothing used. Use was also grouped by tiers of effectiveness [24] via a four-point ordinal scale: 1 = condoms/no method; 2 = BCPs, the patch, or the ring; 3 = the contraceptive injection depot-medroxyprogesterone acetate (DMPA); 4 = LARC. The 48-hour survey assessed if, at the recruitment visit, the participant received contraception, a prescription, or a follow-up appointment/referral for contraception.

[1] "Hispanic" is often used in the literature and refers to individuals residing in the United States who are of Mexican, Central American, South American, or Caribbean origin or ancestry. Our study population prefers and uses the term Latina. Anyone who self-identified as Hispanic or Latina was eligible to participate, including non-hispanophone individuals of Caribbean or South American origin.

[2] We did not collect follow-up demographics on specific country of origin.

[3] Outside of the recruitment visit, there was no other access to the app. By design, the only exposure to the app was through use of an iPad at the clinic during the recruitment visit.

2.4.4. Effectiveness of clinical encounter and app satisfaction

Was assessed by the proportion who reported discussing birth control with their provider and app users' responses to nine satisfaction items at the 48-hour survey (using a 5-point Likert agreement scale). Intervention providers rated their experience with the app on seven items (using the same agreement scale), and impact of the app on visit time (1 = not any time spent to 5 = a lot of time spent) in a survey administered after study recruitment completed. Measures were developed by the research team.

2.5. Analyses

Generalized mixed effects models assessed the effect of the intervention on self-efficacy, nonbarrier contraception use, and change in effectiveness of contraception used over time. Linear regression assessed self-efficacy; logistic regression assessed nonbarrier contraception use; and ordinal logistic regression assessed change in contraception effectiveness. Models included the repeated outcome measure as the response variable, terms for the intercept, study condition, a time effect (pre-app vs. post-app in the contraceptive knowledge model, baseline vs. 48-hours in the model testing the immediate effect of the intervention on self-efficacy, or baseline vs. 3-months vs. 6-months), the time by condition interaction, and 3 covariates: (1) age, (2) reason for visit was for a pregnancy test, EC, birth control, or birth control/pregnancy counseling, and (3) sexual intercourse in the prior 3 months. We fit models with random intercepts and slopes over time to accommodate the repeated measures. The time by condition interaction was the direct test of the intervention effect. Computation of *p*-values was based on robust variance estimation that adjusted for a potential lack of independence between observations due to clustering by SBHC. Contraception discussion and uptake at the recruitment visit were assessed by logistic regression containing the condition effect plus the same covariates included in the mixed effects models with robust variance estimation to account for clustering.

3. Results

3.1. Sample

Of the 3903 youth who touched at least one button on the iPad, 577 declined to participate prior to screening; 1554 were eligible and 117 (7.5%) declined to participate (Fig. 1). The final sample included 1360 participants. All participants were Latina/Hispanic (inclusion criteria) and most (91%) did not report any other race. There were no differences between groups in age, desire to avoid pregnancy, nonbarrier contraceptive use, or self-efficacy; however, there were significant baseline differences in knowledge, purpose of visit and sexual activity (Table 1).

Most intervention participants (95%) completed the app; 57.2% completed the 48-hour survey; 50.1% the 3-month; 49.7% the 6-month; and 42.3% completed both the 3- and 6-month surveys (Fig. 1). Retained vs. dropout analyses yielded no differences in baseline reason for visit, current sexual activity, contraception use, or self-efficacy. However, attrition was higher in the intervention group and dropouts tended to be younger (Table 2). To minimize bias caused by missing data (mostly from attrition), we used multiple imputation using chained equations [25] to replace all missing data on a per analysis basis, generating 50 imputed sets for each regression model. Imputation was performed on the data in wide format (one record per case) to account for dependence in multiple observations per case. Each imputation model contained all variables in the regression model (including the outcome), auxiliary baseline variables identified as correlates of the outcome (baseline measure of the outcome not in the analysis model) and/or attrition/retention (variables in the pre-app sexual health survey that informed the app) [21], and indicator variables representing recruitment site [26]. Missing data were imputed separately for intervention and control cases because this approach has been shown to provide unbiased estimates of the intervention effect even in the presence of high amounts of missing data and differential attrition [27].

3.2. Outcomes

Participants who completed the app and subsequent follow-up surveys demonstrated greater improvements compared to controls.

- The app increased contraceptive knowledge from an average of 3.3 (±1.6) correct responses at baseline to 4.6 (±1.7) immediately after app use (b = 1.62, 95%CI 1.43–1.82, $p < 0.001$).
- There was a time by condition interaction in self-efficacy from baseline to the 48-hour follow-up (Table 3). Self-efficacy increased from baseline to 48-hour follow-up among intervention participants (b = 1.64, 95% CI 1.01–2.27, $p < 0.001$), but not for controls (b=0.48, 95%CI −0.10 to 1.06, $p = 0.11$). An interaction was also observed for change in self-efficacy from baseline to the 3- and 6-month follow-ups (Table 4). Both groups increased from baseline to 3-month (intervention b = 1.95, 95% CI 1.02–2.88, $p < 0.001$; control b = 1.13, 95% CI 0.26–2.01, $p = 0.01$) and 6-month follow-ups (intervention b = 2.57, 95% CI 1.76–3.39, $p < 0.001$; control b = 1.00, 95% CI 0.14–1.85, $p = 0.02$). However, of those who responded to the 6-month survey, self-efficacy increases were larger for app users than controls.
- More app users received a nonbarrier method, prescription, or referral for contraception at the recruitment visit than controls, but the difference was not statistically significant (Table 3). Among those who completed the follow-up survey, intervention participants had greater increases in use of a nonbarrier method from baseline to 3-month and 6-month (Table 4). Simple effects analyses showed an increase in nonbarrier use among app users from baseline to 3-month (aOR = 10.58, 95% CI 4.93–22.70, $p < 0.001$) and 6-month follow-ups (aOR = 12.94, 95%CI 5.52–30.32, $p < 0.001$). For controls, it increased from baseline to 3-months (aOR = 3.22, 95% CI 1.04–9.98, $p = 0.04$), but not from baseline to 6 months (aOR = 2.34, 95% CI 0.86–6.43, $p = 0.10$). Compared to controls, increase in nonbarrier contraceptive use from baseline to 3 months and baseline to 6 months was greater among app users who completed the follow-up surveys. When contraception use was operationalized as method effectiveness, neither the time by condition interaction nor the condition main effect was significant. Disregarding condition, compared to baseline, effectiveness of method used was higher at 3 months (OR = 6.79, 95% CI 3.18–14.53, $p < 0.001$) and 6 months (OR = 4.21, 95% CI 1.84-9.61, $p = 0.001$), but lower at 6 months than 3 months (OR = 0.62, 95% CI 0.42–0.92, $p = 0.02$).
- Of those who completed the 48-hour follow-up survey, more app users (89%) than controls (69%) reported discussing birth control with their provider. This approached but did not reach statistical significance (Table 3). App users reported *Health-E You* improved the quality of the visit (70%), helped them choose contraception (69%), and talk with the provider about contraception (67%). Almost all (93%) understood information in the app; 87% felt it gave useful birth control information; 85% would recommend it to a friend; 85% liked its look/format; and most liked the videos of providers and adolescents talking about contraception (67% and 65%, respectively). While only 6% reported difficulties moving through the app, 43% experienced information overload. Providers reported the app engaged adolescents in the contraceptive decision-making process (83%); supported individually tailored discussions (75%); and

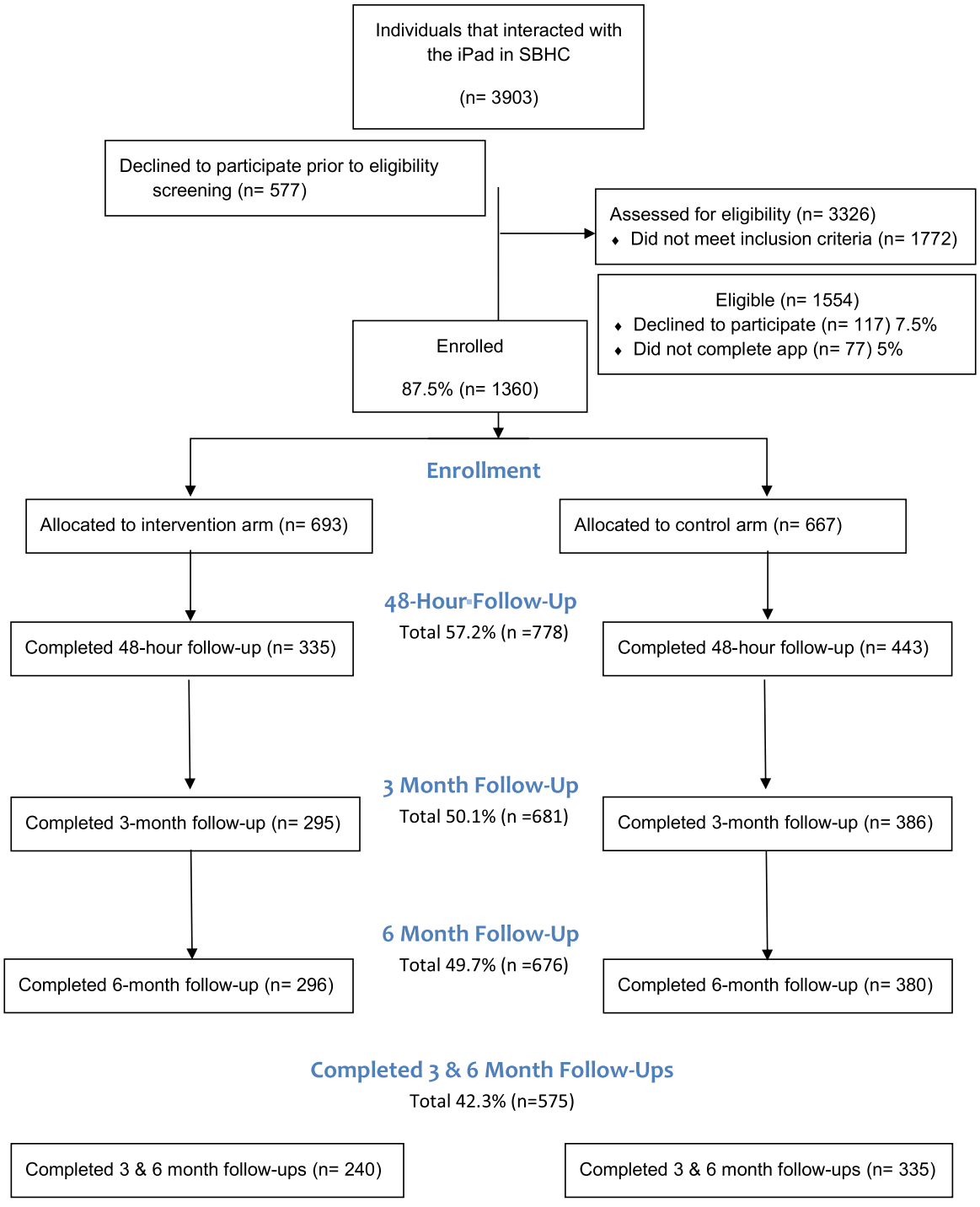

Fig. 1. Consort diagram.

integrated reproductive health into all visit types (50%). When adolescents did not use the app, providers (75%) needed more time to provide contraception education (vs. 58% when adolescents used the app). When adolescents used the app, providers needed less time to screen for contraindications (67% vs. 33%), and to identify the best method for their patient (75% vs. 58%). None reported it made them run behind schedule.

- *Covariates:* All outcomes were adjusted for three covariates (i.e., parameter estimates obtained when the covariates are held constant). Older participants reported higher self-efficacy scores and were more likely to report nonbarrier contraception use (when collapsed across baseline, 3 months, and 6 months). Purpose of recruitment visit was associated with all outcomes as was sexual activity in the prior three months (except for the baseline 3-month and 6-month self-efficacy model). Participants whose recruitment visit was for pregnancy testing, EC, or birth control and those currently sexually active reported higher self-efficacy scores and greater likelihood of non-barrier contraception use. Among those who completed follow-up surveys, the intervention outperformed controls at all follow-up assessments; though, differences were more pronounced among participants whose recruit-

Table 1
Participant baseline sample characteristics in Los Angeles CA 2016-2018.

Characteristic	Intervention (n = 693)	Control (n = 667)	Total (N = 1360)	Intervention vs. Control
Age [mean (SD)]	16.4 (1.1)	16.4 (1.0)	16.4 (1.1)	p = 0.89[a]
14	38 (5.5%)	29 (4.3%)	67 (4.9%)	
15	106 (15.3%)	103 (15.4%)	209 (15.4%)	
16	183 (26.4%)	168 (25.2%)	351 (25.8%)	
17	255 (36.8%)	294 (44.1%)	549 (40.4%)	
18	111 (16.0%)	73 (10.9%)	184 (13.5%)	
Preintervention knowledge score mean #correct (SD)	3.3 (1.6)	2.6 (1.5)	3.0 (1.6)	p < 0.001[a]
Purpose of visit for pregnancy test, emergency contraception, Birth control, or birth control counseling	555 (80.1%)	311 (46.7%)	866 (63.8%)	p < 0.001[b]
Sexually active past 3 months	586 (84.6%)	516 (77.4%)	1102 (81.1%)	p = 0.01[b]
Nonbarrier contraception use past 3 months	197 (28.7%)	197 (30.3%)	394 (29.5%)	p = 0.95[b]
Self-efficacy [mean (SD)]	23.2 (6.3)	22.5 (6.7)	22.8 (6.5)	p = 0.49[a]

[a] p-value computed for χ^2 test using standard errors adjusted for clustering by SBHC.
[b] p-value computed for t test using standard errors adjusted for clustering by SBHC.

Table 2
Participant characteristics stratified by retention status at 6-month follow-up.

Characteristic	6-month status Retained (n = 676)	Dropped Out (n = 684)	Retained vs. dropped out
Age [mean (SD)]	16.5 (1.0)	16.3 (1.1)	p = 0.001[a]
Condition			
Intervention	296 (43.8%)	397 (58.0%)	p = 0.03[b]
Control	380 (56.2%)	287 (42.0%)	
Purpose of visit for pregnancy test, emergency contraception, birth control, or birth control counseling	401 (59.9%)	455 (67.6%)	p = 0.08[b]
Sexually active past 3 months	537 (80.2%)	553 (81.9%)	p = 0.45[b]
Nonbarrier contraception use past 3 months	220 (39.2%)	174 (33.0%)	p = 0.15[b]
Self-efficacy [mean (SD)]	23.2 (6.1)	22.5 (6.9)	p = 0.31[a]

[a] p-value computed for χ^2 test using standard errors adjusted for clustering by SBHC.
[b] p-value computed for t test using standard errors adjusted for clustering by SBHC.

Table 3
Receipt of services at visit and participant self-efficacy assessed at 48-hour follow-up.

Outcome	Intervention	Control	Intervention vs. control aOR (95%CI)
Discussed birth control with clinician at recruitment Visit [n yes/n total (%)]	285/320 (89.1%)	301/436 (69.0%)	2.22 (0.98, 5.01)[a]
Received nonbarrier contraceptive method at recruitment visit [n yes/n total (%)][b]	236/319 (74.0%)	221/436 (50.7%)	1.66 (0.73, 3.78)[a]
Outcome	Intervention	Control	Intervention vs. Control b (95% CI)
Self-efficacy [mean (SD) n]			
Baseline	23.2 (6.3) 690	22.5 (6.7) 640	1.16
48 hours	25.2 (5.1) 320	23.0 (6.4) 437	(0.26, 2.07)[c]

[a] Logistic regression parameter estimate for Condition main effect adjusted for age; whether or not purpose of visit was for pregnancy test, emergency contraception, birth control, or birth control counseling; and whether sexually active in past 3 months. SEs adjusted for clustering by SBHC.
[b] Receiving contraception included in-time acquisition, a prescription, or a follow-up appointment/referral for contraception.
[c] Mixed effects linear regression parameter estimate for Time × Condition interaction adjusted for age; whether or not purpose of visit was pregnancy test, emergency contraception, birth control, or birth control counseling; and whether sexually active in past 3 months. SEs adjusted for clustering by SBHC. Parameter tests Intervention vs. Control difference in baseline-to-48 hours change in outcome.

ment visit was *not* for pregnancy testing, EC, or birth control (Table 5).

4. Discussion

Health-E You increased knowledge, self-efficacy and use of nonbarrier contraception (118% vs. 45% for controls) among participants who completed the 6-month follow-up. *Health-E You* may be useful in reducing the gap between desire to avoid pregnancy (>80% at baseline) and contraceptive use (<30% at baseline). Providers overwhelmingly reported the app engaged adolescents in the contraceptive decision-making process, supported individually tailored discussions, helped integrate reproductive health into all visit types, and had no adverse impacts on clinic flow or time. Most app users completed the app (95%) and reported high app satisfaction. While the app was designed to overcome barriers in existing web-based tools (e.g., difficult to access, understand and navigate [28,29]), many users (43%) experienced information overload. Future research should examine ways to address this issue.

There are important study limitations. Attrition rates in competing follow-up surveys were high in both groups, but greater in the intervention group. Reasons for attrition include: incorrect/invalid contact information, high migration (both leaving school and/or the region), and concerns about family members' immigration status (an issue identified by other researchers studying similar pop-

Table 4
Contraceptive use and self-efficacy outcomes at 3-month and 6-month follow-ups in Los Angeles CA 2016-2018.

Outcome	Intervention	Control	Time × condition interaction aOR (95% CI)
Nonbarrier contraception use past 3 months[a] [n yes/n total (%)]			
Baseline	197/687 (28.7%)	197/650 (30.3%)	
3 months	162/257 (63.0%)	161/359 (44.8%)	3.29 (1.04, 10.36)[b]
6 months	185/295 (62.7%)	166/379 (43.8%)	5.54 (1.70, 18.06)[c]
Contraception effectiveness past 3 months[d] [n category/n total (%)]			
Baseline			
No nonbarrier method	490/687 (71.3%)	453/650 (69.7%)	
Pill/patch/ring	125/687 (18.2%)	108/650 (16.6%)	
DMPA	72/687 (10.5%)	89/650 (13.7%)	
IUD/implant	0	0	
3 months			
No nonbarrier method	95/257 (37.0%)	198/359 (55.2%)	
Pill/patch/ring	75/257 (29.2%)	59/359 (16.4%)	
DMPA	67/257 (26.1%)	73/359 (20.3%)	
IUD/implant	20/257 (7.8%)	29/359 (8.1%)	
6 months			
No nonbarrier method	110/295 (37.3%)	213/379 (56.2%)	
Pill/patch/ring	83/295 (28.1%)	65/379 (17.2%)	
DMPA	81/295 (27.5%)	68/379 (17.9%)	
IUD/implant	21/295 (7.1%)	33/379 (8.7%)	
Outcome	Intervention	Control	Time × Condition Interaction b (95% CI)
Self-efficacy[e] [mean (SD) n]			
Baseline	23.2 (6.3) 690	22.5 (6.7) 640	
3 months	25.2 (4.9) 282	23.4 (6.1) 379	0.82 (−0.48, 2.11)[b]
6 months	26.1 (4.4) 292	23.4 (6.0) 379	1.58 (0.38, 2.77)[c]

[a] Overall test of Time × Condition interaction derived from mixed effects logistic regression model adjusting for age; whether or not purpose of visit was pregnancy test, emergency contraception, birth control, or birth control counseling; and whether sexually active in past 3 months with SEs adjusted for clustering by SBHC was statistically significant at $p = 0.025$.
[b] Parameter tests Intervention vs. Control difference in baseline-to-3 months change in outcome.
[c] Parameter tests Intervention vs. Control difference in baseline-to-6 months change in outcome.
[d] Overall test of Time × Condition interaction derived from mixed effects ordinal logistic regression model adjusting for age; whether or not purpose of visit was pregnancy test, emergency contraception, birth control, or birth control counseling; and whether sexually active in past three months with SEs adjusted for clustering by SBHC was not statistically significant at $p = 0.11$.
[e] Overall test of Time × Condition interaction derived from mixed effects linear regression model adjusting for age; whether or not purpose of visit was pregnancy test, emergency contraception, birth control, or birth control counseling; and whether sexually active in past 3 months with SEs adjusted for clustering by SBHC was statistically significant at $p = 0.04$.

Table 5
Outcomes stratified by whether or not purpose of recruitment visit was for pregnancy test, emergency contraception (EC), birth control, or birth control/pregnancy counseling in Los Angeles CA 2016-2018.

	Purpose of visit **NOT** for pregnancy test, EC, birth control, or birth control counseling		Purpose of visit **for** pregnancy test, EC, birth control, or birth control counseling	
	Intervention	Control	Intervention	Control
Discussed birth control with clinician at recruitment visit (% yes)	70.5	54.9	95.0	85.6
Received nonbarrier contraceptive method at recruitment visit (% yes)	41.6	30.2	84.6	74.4
Self-efficacy – Immediate effect (mean)				
Baseline	22.03	21.20	23.53	23.90
48 hours	24.71	21.93	25.35	24.43
Nonbarrier contraception use past 3 months (% yes)				
Baseline	29.9	27.6	28.6	33.4
3 months	52.9	31.7	65.9	62.7
6 months	49.2	32.7	66.5	57.7
Self-efficacy – Longer term effect (mean)				
Baseline	22.03	21.20	23.53	23.90
3 months	24.74	22.02	25.33	25.10
6 months	25.39	22.11	26.37	24.97

ulations [31,32]). Conducting longitudinal research is challenging, particularly with groups who have experienced discrimination and who have high migration rates, more needs to be done to earn trust and increase their engagement in research. Differential attrition could bias and overestimate the intervention's effect [33], especially if participants did not complete follow-up surveys due to app dissatisfaction. This, however, is unlikely because app completion and satisfaction were high. Differential attrition was likely due to outreach efforts of one control clinic that encouraged participants to complete follow-up surveys, resulting in higher overall

completion rates controls. We expected staff at all SBHCs to conduct similar outreach efforts; however, most lacked time to do so. Thus, we relied on electronic follow-up reminders which yielded retention rates similar to other studies using this method [34-36]. To account for differential attrition, we employed multiple imputations as the most appropriate statistical approach to produce estimates of the intervention effect [27, 37]. However, if data are not missing at random, multiple imputations may not adequately address or possibly exacerbate bias. Because data is missing, it is not possible to determine the extent to which this is a problem [38]. As recommended, we have detailed our multiple imputation approach [38]; regardless, findings must be interpreted cautiously.

Another major limitation was that, despite randomization, intervention participants, compared to controls, had significantly higher rates of sexual activity and the recruitment visit was more likely to be for a pregnancy test, EC, birth control, or birth control/pregnancy counseling. It is possible that staff at the intervention sites was more likely to offer the app to adolescents coming in for these reasons and/or adolescents seeking care for these reasons may have been more interested in using the app than adolescents coming for other reasons. We interviewed providers and observed each SBHC but did not identify differences in the provision of services across clinics. It is also possible that app use improved the "climate" for and increase utilization of reproductive/contraceptive services at intervention clinics. Following standard practice to statistically adjust for these possible other determinants of the outcomes, multivariate regression models were used (i.e., the adjusted odds ratios reported for the intervention effect are the odds ratios observed when covariates are held constant). Nevertheless, if intervention participants were more likely to be having sex or seen for pregnancy testing or contraception than controls, one might expect they would have better outcomes than controls at follow-up. Because of these limitations, findings must be interpreted cautiously.

Health-E You was used in the context of a SBHC visit and thus it is important to generate strategies to leverage technology outside the clinical setting to reach more youth in need of contraceptive services as well as evaluate its use in different clinical contexts. Given this study sample, the app may be particularly useful in engaging adolescents at high risk for unintended pregnancy (e.g., those being seen for a pregnancy test, or EC). At the same time, providers reported the app helped integrate reproductive care into non-reproductive visit types thereby providing contraceptive care to adolescents who might be in need of but not seeking contraceptive services. More research is needed to determine the effectiveness of the app and for whom.

Despite limitations, this study makes a significant contribution to the field of computer-based contraceptive decision support tools. Few prior studies have shown improvements in use of effective contraceptive methods, especially over time, and most were limited to family planning visits. Use of tailored feedback/reminders can improve contraceptive continuation [30] and possibly improve study retention; however, *Health-E You* does not currently have this component. This study also represents an important effort to support Latina adolescents' contraceptive decision-making; however, more research is needed to better understand and develop culturally specific interventions to address disparities and advance health justice for Latinx youth – a diverse group and the largest growing population of adolescents in the U.S. [39].

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.contraception.2021.03.004.

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