
Sonia K. Gonzalez Gladstein
sonia.gonzalez88@sphmail.cuny.edu

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ACCEPTABILITY STUDY AND PILOT RCT OF GUIDE TO UNDERSTANDING
REPRODUCTIVE HEALTH FOR LADEEZ (GURHL) CODE:
AN HIV RISK REDUCTION APP INTERVENTION FOR BLACK AND LATINA
YOUNG ADULT WOMEN IN NEW YORK CITY

A DISSERTATION

by

SONIA K. GONZÁLEZ GLADSTEIN

Concentration: COMMUNITY, SOCIETY, AND HEALTH

Presented to the Faculty at the Graduate School of Public Health and Health Policy in partial
fulfillment of the requirements for the degree of Doctor of Public Health

Graduate School of Public Health and Health Policy
City University of New York
New York, New York
DECEMBER 2017

Dissertation Committee:

CHRISTIAN GROV, PhD, MPH
BETTY WOLDER LEVIN, PhD
DENIS NASH, PhD
CHRISTINA ZARCADOOILAS, PhD
JEFFREY BIRNBAUM, MD, MPH
ABSTRACT


by

Sonia K. González

Advisor: Christian Grov

Background: Young Black and Latina women suffer from higher sexually transmitted disease (STD) incidences than White women, increasing their susceptibility to contracting human immunodeficiency virus (HIV). The adoption and widespread usage of mobile devices has contributed to the public’s ability to access available information at all hours, including information on sexual and reproductive health (SRH). Despite a growing body of mobile health literature, there is limited understanding of how mobile-based sexual and reproductive health interventions for use by young adult Black and Latina women could improve sexual health knowledge and connection to clinical care.

Methods: This pilot randomized controlled trial evaluated preliminary efficacy of a web-based application (web-app) designed to increase knowledge of HIV and other STDs and to facilitate awareness and use of SRH care via a texting function and a clinic search tool. Participants were assigned randomly to use either the intervention web-app or a standard web-app and were administered knowledge, feasibility, and acceptability assessments at baseline and at follow-up 3 months later. Additional focus groups (n = 4) were conducted after the 3-month follow-up survey was completed and the circumstances around usage (at school, at work, in crisis, for information
sharing), attitudes toward the web-app, and barriers to using the app were assessed as were the participants’ perspectives on the apps’ usefulness, trustworthiness, and usability. Inclusion criteria were: self-identified Black or Latina women aged 18 to 25 who owned a smartphone, were living or working in New York City, and reported vaginal or anal intercourse with a male partner in their lifetime. The study compared those who enrolled in the research study to those who were eligible but chose not to enroll on age, race, relationship status, education, individual income, employment status, insurance status, condomless sex acts in their lifetime, number of male sex partners in their lifetime, age of oldest male sex partner, and age of first sexual intercourse. Comparisons were made using t-tests, chi-square, or Fisher’s exact tests as appropriate (Aim 1, n = 156). In addition, drawing from self-report data, the study compared the cost per enrollee by recruitment source. To assess the feasibility and acceptability of the web-app created for this dissertation, focus group results were triangulated with baseline, post-surveys, and analytics results. We compared the treatment arms on demographics, health risk behaviors, understanding of other web-based applications, usability items, and web analytics using t-tests, chi-square, or Fisher’s exact tests, as appropriate. Focus groups were conducted by study arm and findings reported thematically by intervention and control arm (Aim 2, n = 105, 4 focus groups). To explore preliminary efficacy, analyses additionally compared self-report access to reproductive health services and SRH knowledge using t-tests, chi-square, or Fisher’s exact tests, as appropriate (Aim 3, n = 105). All procedures were reviewed and approved by the City University of New York Institutional Review Board (protocol # 381039).

Results: The Guide to Understanding Reproductive Health for Ladeez (GURHL) Code study found that recruiting via college professors through emails and college LISTSERVs was more effective than recruiting via Facebook banner advertisements. Data on the banner ads and the
findings reported by enrollees both revealed that potential enrollees responded more favorably to banner ads that included the study logo and images of women, rather than those displaying the logo alone. Women who enrolled in the GURHL Code study were more likely to report an income below $20,000 and to be working or to be a student than were the women who were eligible but did not enroll. Triangulating focus groups, survey responses, and web analytics results suggest participants were enthusiastic about several aspects of the intervention GURHL Code web-app in comparison to the standard-of-care control web-app. These aspects included the clarity in language, transparency of the developer and designer, access to the Planned Parenthood text function, and Questions, Honest Answers. Participants from both treatment conditions found both web-apps easy to use and well organized, and additionally found the GURHL Code intervention web-app to be trustworthy and useful. We found high retention rates, successful randomization, and non-differential findings on knowledge or connection to care. 

**Discussion:** The study found that GURHL Code, a theory-driven sexual and reproductive health (SRH) mHealth study, was feasible and acceptable among Black and Latina women 18 to 25 years old in New York City and that it merits a larger scale study to explore SRH knowledge and connection to SRH care. Future research might include a suite of web-apps available in the marketplace (e.g., Google Play and Apple’s App Store) tailored for various sub-populations of women. These could include teenaged women and parents or caregivers of young women. Cross-sector collaborations are needed to advance the health-technology field, especially with mobile designers, developers, and e-marketers.
DEDICATION

This dissertation is dedicated to my *Tita*, my grandmother, Angela Martinez Kräpp. After her US-born husband died while they were raising their family and living in Mexico, she up-rooted her family from Ciudad Juárez, México to El Paso, Texas in order to maintain American citizenship for their children. This was a demand placed on them by the US government. She understood that the US offered opportunities, especially for her 3 daughters, that her beloved home country of México did not. The sacrifices she and my family endured for future generations of our family are not lost on me and I will be forever grateful.

My *Tita* gave me some advice that has served me well—*No te dejes mi’ja*. She was the toughest and bravest person I have ever known and I hope that my research and future work are always carried out with her spirit, fire, and sense of social justice.
ACKNOWLEDGEMENTS

There is an African proverb that says it takes a village to raise a child. I believe this notion extends to training a researcher and public health scholar. As such, I am grateful to the following.

To all the teachers in my life: may you never stop teaching, and may I never stop learning. I extend a special note of thanks and gratitude to my dissertation committee for their patience, guidance, and time. I am especially grateful to my Chair, Christian Grov, for the time spent thinking through how to over-come the tougher obstacles presented throughout this process. To my Tae Kwon Do instructors, Grand Master Villareal, Masters Segovia, and Rangel, and to my fellow students, who provided training and a foundation for approaching life. Those lessons have given me the mental toughness to follow through and to overcome life’s challenges. To Dr. Bea Krauss and my fellow fellows of the NIMH R25 mentoring fellowship and especially to Jagadisha and Geetha for regularly checking in throughout my doctoral student tenure. To the Interactive Technology & Pedagogy certificate program and the New Media Lab at the Graduate Center for instilling a “fail forward” approach to mobile health work. I am especially grateful to Dr. Steve Brier, Michael Mandiberg, Andrea Vasquez, Matt Gold, PhD, Luke Waltzer, PhD, and Joe Kirchhoff for their mentorship and the digital scholarship they foster at CUNY’s Graduate Center. It has been my honor and pleasure to be part of that community.

I had the privilege of working side by side with the incredible team formerly known as the Sexual Reproductive Health Rights Arm at the Ford Foundation, on two separate occasions with the Health Lab team, and with Dr. Daliah Heller during my tenure as a doctoral student. Thank you for your never-ending encouragement and for modeling what effective and supportive
teams are. These lessons were equally as important to the trajectory of my career as were the technical skill sets I have learned.

To colleagues in the CUNY DPH program—we are a unique bunch of students and NYC residents, many of whom have served the public of NYC for many years as activists, health educators, and researchers long before coming to the CUNY School of Public Health. It is because of the rich experience offered by the CUNY DPH Students that this program has engendered a unique classroom and doctoral student experience. It is my hope that the school values this experience and continues to strive to find ways to support New Yorkers who are committed to serving and researching the rich and wide range of experiences among New Yorkers. The CUNY mission statement is to serve New Yorkers, and I am proud not only that we have a collection of New Yorkers, but that all members of this collection are committed to improving the quality of lives of all New Yorkers and are social justice minded. The existence of a doctoral student can be isolating and I am grateful for the connections within this program.

I am particularly grateful to Drs. Lauren Dinour, Michael Schmeltz, Amy Kwan, Liza Fuentes, and Dana Watnick for our work sessions, the friendship you have offered, and the emotional support I needed that few others understood how to provide. I am additionally proud of our shared productivity—from NIH and other prestigious grants to publications, securing impressive positions, and conducting research that was referenced in a Supreme Court case. I will always think fondly of our time together as doctoral students and look forward to many future years of friendship, collaboration, and support. To these CUNY DPH colleagues who inspire me to continue striving to do the best public health work and research in addition to those mentioned above: Vivian Cortés, Linda Greenspan, Drs. Nisha Beharie, Ellen Wiewel, Courtney McNight, Rachael Weiss, and Margaret Wolff. 
The foundation of this dissertation research is highly collaborative. I am grateful to the community advisory committee and individual and organizational experts who contributed content and expertise to assist in developing gurhlcode.org and who helped inform its study design. Thanks to partnering agencies including Bedsider, Planned Parenthood of America, Ibis Reproductive Health, and Love Heals: The Alison Gertz Foundation. And thanks to the formal and informal advisory members of this project: Jennifer Irwin, Kim Sanders, Rachael Morgan Peters, Myra Hellerstein, Amy Kwan, Neal Blangiardo, Emmanuella Murat, Francis Medina, Destiny Washington, Hope York, Niko Flowers, and JaLove, Vivian Cortés, and Kimbirly Mack.

It has been my privilege to work with many talented Master’s of Public Health students throughout this project: Dawn Jacob, Marianne Hurewitz, Simon Sandh, Catherine Dinh-Le, and Keisha Sprott. I look forward to learning of the future contributions you make as you continue on your own paths.

To Aeli and Gael and our families for all of your support through the incredible amount of juggling over the last several years. You have all offered unwavering support. Special thanks to Aeli for making sure my basic needs were met when I did not care to think about them. For example, thanks for making sure I ate even when I just wanted to keep on working, for supporting me and challenging me, hearing me talk about my research ad nauseam since circa 2011; for a connection to the world outside of public health; for being a super awesome partner and father; and for bringing lots of laughter to our home. I could have done this without you, but I am happier for not having had to tackle it on my own. I look forward to many more adventures together! To Gael Manuel, for our work breaks through games, laughter, hugs, and kisses. I look forward to a lifetime of learning experiences with you, my sweet Bebé. I hope to offer you the support and love my own Mama provided me and the security and laughter that my Tías Alma
and Julia have offered. Family comes in various forms and I am fortunate to feel the love and support of my and my partner’s family as well as to my “PopFam” family whom I came to meet while earning our Master’s of Public Health at Columbia University together and whom I have known since 2001. I am grateful and inspired by our deep friendship, love, and support.

The training I have received would not have been the same without the support of the National Institute of Mental Health that generously provided the funding for my pre-doctoral fellowship (F31-MH099924). A special note of thanks goes to my F31 Sponsors, Drs. Denis Nash and Christina Zarcadoolas. It has been a long road, and I am grateful for your mentorship.

Disclosure Statement: I have no conflicts of interest to disclose.
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CHAPTER 1—Introduction

BACKGROUND

Public health need: STD disparities among young adult women of color

In the United States, compared to White women, young Black and Latina women experience higher rates of sexually transmitted diseases (STDs),\(^1\) including the human immunodeficiency virus (HIV).\(^2\) The chlamydia rate among Black women is 1,433 per 100,000, which is 5.7 times the rate for White women (253).\(^1,3\) From 2000 to 2013, New York City-resident Black women aged 18 to 25 had the highest chlamydia incidence compared to all groups, including classifications by gender, race/ethnicity and in 5-year age groups.\(^1,4–7\)

Women’s STD risk increases their susceptibility to HIV transmission and can lead to long-term reproductive complications such as infertility.

Despite a decrease in new HIV diagnoses among women in the United States between 2005 and 2014,\(^8\) racial and ethnic disparities persist between Black and Latina women and White women. In 2014, the HIV incidence for Black women was 16 times higher than that for White women.\(^9\) Moreover, Black women accounted for 6 in 10 diagnoses among women in 2014.\(^8\) Although Latinos made up 17% of the US population, they accounted for 23% of newly estimated diagnosed HIV infection.\(^8,10\) In addition, despite decreases in HIV diagnoses, declines have stalled between 2009 and 2014 for Latinos,\(^8\) and in 2015, 80% of the 8,807 young people diagnosed with HIV in the United States were aged 20 to 24.\(^11\) These data highlight the need to continue conducting research to better understand the factors that contribute to STDs, including HIV, among young adult Black and Latina women.
Delayed healthcare seeking

Latinas are less apt to undergo regular Pap tests than White women, and may also defer important opportunities to ask sexual-health–related questions and to perform STD testing and other screenings. In addition, many young people aged 15 to 24 delay seeking care for an STD for a range of reasons including thoughts of being “blamed” for an STD by a partner, and time constraints to schedule STD screening. Anatomical differences between women and men facilitate earlier self-detection of STD symptoms by men (e.g., men touch their genitalia multiple times a day to urinate). Women are also more likely to confuse STD discharge symptoms for normal discharge or yeast-related symptoms, or not to seek STD screening due to being asymptomatic. Delayed healthcare-seeking behaviors has long-term consequences, especially for women; if left untreated, STDs can be transmitted to fetuses during pregnancy development or during delivery, and untreated STDs can lead to pelvic inflammatory disease, which can result in infertility and ectopic pregnancy. Further, Latinas suffer a disproportionate mortality rate from breast and cervical cancers.

Why researchers utilize mobile technology for health studies?

Given that young people are early adopters of new digital technology, one avenue to combat public health disparities and to meet public health needs is via mobile technology. Widespread smartphone ownership is common (68% of American adults own a smartphone), especially among young adults—86% of Americans between 18 and 29 years of age are smartphone owners. Both Blacks (70%) and Latinos (71%) are more likely than Whites (61%) to own a smartphone, and are more likely to use their phones for a wider range of activities including accessing the Internet and seeking health information; 73% of Hispanic and 67% of Black compared to 58% of White smartphone owners have used their phone in the past year to...
research a health condition. Smartphone applications offer portability and autonomy (allowing for access at the participants’ desired location and time); cost-effectiveness and content standardization (technology reduces need for staff-related costs); and includes interactive delivery of health information. In addition, most mobile phone users have their phones turned on and within reach during waking hours, and young Americans report sleeping with their phones nearby. If public health researchers and practitioners aim to reach young people to improve health behaviors and outcomes, we need to better understand how to leverage their technological tools.

**Lessons learned from eHealth and mHealth**

Alongside the rapid and growing shift in technology usage since the public availability of the World Wide Web in 1994, researchers have explored how the Internet might be incorporated into the research process. Researchers have explored “the use of information and communication technologies (ICT) for health” which the World Health Organization defines as *eHealth*. With the increased prominence of mobile technology, mobile health, or *mHealth*, is understood to be a component of eHealth. Specifically, WHO defines mHealth as “the use of mobile and wireless technologies to support the achievement of health objectives” and an mHealth strategy is the application of technology for a defined health purpose (e.g., text messages to deliver appointment reminders) in order to address specific health system challenges. These digital tools provide the possibility of delivering health information, professional consultation, and health provider and services cost and location information to individuals in a way that is more timely and private, and thus more useful, than traditional health education and service delivery models that require individuals to physically travel to a clinic or school for such services. Characteristics that make mHealth tools well suited for public health
interventions include their scalability (that is, potential for widespread use, a goal of translational science) at a relatively low cost (making implementation of the intervention for translational science achievable), tailoring, interactivity, personalization, and delivery at a desired dosage (i.e., message repetition).³¹–³³

The pioneers of mHealth research began exploring their usage in clinical settings soon after short message service (SMS or texting) became commercially available for people to communicate via brief electronic messages usually between mobile phones in 1996.³⁴ This seminal work is demonstrative of the impact mHealth can have on connection to care. Two systematic reviews have described robust evidence when using text message reminders to improve health care appointment attendance.³⁵,³⁶ There is also evidence that receiving both negative and positive laboratory results via SMS was found to be as acceptable as a letter or telephone call.³⁷ SMS is also an effective communication tool between patients and health care providers, including hard-to-reach populations (e.g., commercial sex workers), communication of sexual health education, and partner notification of STD diagnosis in Amsterdam.³⁷ In geographically isolated areas, health care workers were able to text updates to physicians about HIV and AIDS patients for immediate recommendations.³⁷ Since the early days of SMS, mHealth tools have been developed and researched for a variety of populations and for a variety of public health purposes. Interactive digital tools, including mobile devices, offer users health information, online communities, and behavior change and prevention tools (i.e. health self-management, and disease monitoring and management including electronic health tools).³⁸

Findings from sexual mHealth research suggest there are good opportunities for recruiting research participants via Facebook banner advertisements, particularly for cross-sectional studies with a variety of populations including young adults, trans-women, college
students, and men who have sex with men (MSM). However, samples of women for sexual and reproductive mHealth research are typically drawn from a combination of in-person clinical or community-based sites, leaving a gap in understanding of how banner ads might be utilized to recruit women and sub-populations among women (i.e., Black and Latina women).

Specifically, despite successfully recruiting young people of color, including MSM, utilizing targeted electronic outreach and social networking approaches for STD and HIV research with other populations, there are few studies using these methods that focus on young adult women and even fewer focusing on Black and Latina women, especially in randomized controlled trials.

There are many mHealth interventions currently available intended for influencing behavior change, tracking and sharing data, lifestyle education and management, and continuing professional education tools. Sexual and reproductive mHealth interventions intended for women have widely ranged from investigating topics including pregnancy, nutrition and pregnancy, intimate partner violence during pregnancy, contraception, fertility tracking for family planning, preventing unintended pregnancy, menstrual cycle tracking, HPV, breast cancer screening, measuring ovulation through the use of a wearable device, and iron deficiency in premenopausal women. Some of the positive findings from this body of mHealth literature are especially promising. For example, the MyHealthy Pregnancy App found participants’ attendance at prenatal appointments was 84% compared with the clinic norm of 50%, indicating an estimated cost savings of ~US $450/patient over 3 months. After 6 months of coaching on the web-based mHealth platform, Smarter Pregnancy, lifestyle behaviors improved for vegetable intake, fruit intake, folic acid use, no tobacco use, and no alcohol consumption. In addition, the program showed the strongest effectiveness for participating...
couples. Evaluating the effectiveness of a web-based tailored intervention for promoting HPV vaccination acceptance showed a significant positive effect of the intervention on informed decision making, decisional conflict, and nearly all determinants of HPV vaccination uptake.

However, there are a limited number of sexual and reproductive mHealth studies tailored for Black women. One such study focused on the risk of adverse birth outcomes, another on HIV risk reduction via video delivery study, and 3 others include the Wingood and DiClemente group-level suite of the Centers for Disease Control and Prevention Diffusion of Evidence-Based Interventions (DEBI’s) adapted for computer delivery. Sisters Informing, Healing, Living, and Empowering (SiHLE) Web was designed for young women aged 14 to 18, Women Involved in Life Learning from Other Women (WiLLOW) was designed for HIV-positive women, and SAHARA (the computer version of the Sisters Informing Sisters on Topics about AIDS [SISTA]) program targeted adult women. SiHLE Web, WiLLOW, and SAHARA required participants to travel to a clinical or to a community site to engage with the technology, and required personnel to deliver the intervention content. The Amor y Salud intervention in Oregon used mixed media—radio, social media, and print materials—to encourage Latinas to consider their preconception health. Despite anecdotal positive comments from community members and local media regarding the radionovela, the small sample size of the online and intercept survey data (not reported) prevented researchers from measuring knowledge impact. We found no other sexual and reproductive mHealth studies that have focused specifically on Latina young adult women.

There is a growing body of literature around the formative development of smartphone applications. However, there is limited research on the feasibility and acceptability of sexual mHealth interventions, and even less data is available specific to Black and Latina
A systematic review found sexual and reproductive health (SRH) web-apps suffered from disapproving reviews, limiting uptake, usage, and diffusion. Moreover, research specifically on young adults’ experiences and views on a range of web-app features is lacking, particularly with regards to sexual and reproductive mHealth tools for Black and Latina women. Examples of mHealth tools with favorable feasibility and acceptability include the HealthMindr App tailored for MSM, and an LGBT web-based intervention, both were designed with input from their respective target populations and driven by theoretical underpinnings.

Of note, there is a growing body of mHealth SRH research among college women. For example, mobile and web-based interventions aimed at college-aged women have addressed issues such as alcohol use, sexual assault, abusive relationships, and knowledge of long-acting reversible contraception (LARC) methods. However, these studies either do not report a sample description or they have attracted low proportions of Black and Latina women. Mobile health could serve as an important bridge to educate women about sexual and reproductive health issues, including HIV and other STDs. Given that young adult Black and Latina women, aged 18 to 24, have higher HIV, chlamydia, and gonorrhea incidence compared to their White counterparts, have a need for SRH services, and have a high rate of smartphone ownership, unique opportunities may exist to utilize mobile platforms to decrease HIV and other STD risk behaviors in this population.

**Inclusion of women in randomized controlled trials**

Given the limited number of studies focusing on young women of color in sexual reproductive health technology, this research will have an impact on the insight and potential of future studies engaging with this population on these topics. The few studies on young adult
Black and Latina women, especially in randomized controlled trials (RCTs), constrain our ability to generalize findings and to ensure that our findings are applicable to diverse populations. In addition, low participation levels by women of color in RCTs may overestimate the magnitude of effect by including more advantaged participants and by contributing to ceiling effects. By only including women who are healthier or less at risk, study results might seem more effective than they are, or, put another way, researchers should be careful not to make claims regarding the efficacy of a recruitment approach for all when sub-populations at greater risk for STDs are excluded from research.\textsuperscript{107–109} Increased proportions of people of color in studies will also allow sufficient sample size for ethnic-specific analyses and data presentation.\textsuperscript{107}

Public health researchers and practitioners must understand the historical context of RCT recruitment if we are to address public health outcomes that adversely and disproportionately impact Black women and Latinas, such as STDs. The Tuskegee experiment hinders public health research and contributes to the difficulty of recruiting people of color, especially Black people, for STD intervention trials, including HIV.\textsuperscript{107,110–113} Despite an NIH mandate to explain minority and women exclusions, there are still a limited number of studies, especially RCTs, published in recent years that focus on women of color.\textsuperscript{114} It is a priority for NIH to recruit participants from underrepresented communities,\textsuperscript{115} nevertheless, only a few SRH-technology studies currently in progress focus on women of color or on people of color.\textsuperscript{47} In addition, with an increasing number of public health web-apps every day and with the growth of health technology research, the implications of these findings are relevant for researchers and public health practitioners. The public health community would benefit from better understanding how banner ad recruitment via social and online dating websites and offline platforms could be utilized to recruit young Black and Latina women aged 18 to 25 from an urban setting for research, as well as from an
exploration of how a web-based application tailored for this sub-population does regarding feasibility, acceptability, and the preliminary efficacy to improve sexual health knowledge and connection to clinical services of a sexual and reproductive mHealth study.

CONCEPTUAL FRAMEWORK

Social science and educational theories

Accessing SRH services has been linked to environmental, personal, and behavioral factors. The Social Cognitive Theory (SCT) considers the context of influences in participants’ lives and provides a multi-level (environmental, structural, individual cognitive) framework to provide a comprehensive understanding of the influences on why and how people change individual behaviors (Figure 1).\textsuperscript{116,117} SCT has been widely used to guide HIV risk reduction, particularly among young women of color, including to guide a weekly soap opera intervention to reduce HIV risk among young Black Women, and including Wingood and colleagues’ suite of CDC DEBIs intended for Black women.\textsuperscript{55,87,117–121} Another framework guiding this pilot project given the use of interactive technology draws from research and practical interactive pedagogical applications that demonstrate the potential of technology to increase access to knowledge and information and to promote learning.\textsuperscript{122–124} Particularly relevant for the proposed study are the interactive features allowing participants to learn through visualizations, such as the “how to properly put on condoms” images.\textsuperscript{125}

Digital constructs: usability, user experience, and user-centered design

The notion that content, structure, function and design are fundamental elements for the success of interactive digital media tools has been central to the evolution of the Internet since its inception in 1994 and has been maintained as an important aspect of web development; however, these constructs have not been explicitly applied to designing sexual and reproductive mHealth
applications. Thus, common digital constructs are defined prior to considering how they might influence a sexual and reproductive mHealth web-based application for Black and Latina women vis-à-vis the DT approach. Usability and user experience (UX) development have evolved similarly. UX and user-centered design (UCD) are subjective and more of an art than a science. Despite the subjectivity of the notion of “experience,” the process used to achieve good UCD, the dominant web design approach, includes research that determines user motivation, sketches that address what the user needs, rapid prototyping of the most promising ideas to evaluate them more accurately, and repeating these steps as needed. The rise of UX captures all aspects of non-instrumental, aesthetic, affective, emotional qualities in the human use of digital technology: UX and UCD are often used interchangeably, and the differences are subtle and somewhat semantic—to clarify, UCD situates the user at the center of the experience with the technical product while UX emphasizes the experiential and allows for a balance between user needs and business goals.

These digital constructs come together in Design Thinking (DT) to promise not simply aesthetics and utility, but a deep understanding of human experience to then develop a product, service, or process that improves an experience for many—often empowering people in new ways. DT values empathizing with the user to create solutions for their needs and values, and it emphasizes constant innovation and problem solving (rather than technology for technology’s sake). Specifically, DT develops through 3 iterative stages: 1) inspiration, in which one identifies an opportunity; 2) ideation, in which one conceives general solutions; and 3) implementation, which involves prototyping and testing a product (Figure 2). Another important aspect of DT is divergent thinking, which can be achieved by assembling a multidisciplinary team with various perspectives. Implementing a DT approach in the
Guide to Understanding Reproductive Health for Ladeez (GURHL) Code study facilitated developing a product by and for Black and Latina young adult women in an urban setting that can help to contextualize the environmental and cognitive factors to help support improved behaviors that are specific and responsive to the needs of this community. We identified the needs of the community via multiple perspectives including the voices of women reflective of the population of interest, adult providers who had a history of serving the population of interest, the PI’s 15-year public health career serving marginalized young people, and through formative focus groups. This study facilitates free access to sexual and reproductive care via a button on the web-app that directly connects participants to a Planned Parenthood Federation Health Educator, a clinic search button with a link to directions, and appropriate and easy-to-understand language addressing SRH education tailored for young adult women (other specific content are explained in the following section). As the long-term goals of this project are to explore efficacy through a large-scale RCT and to produce a web-app for real-life settings, these theories and inputs appropriately guide this work. What follows is a description of the inspiration, ideation, and implementation of the crux of this dissertation called Guide to Understanding Reproductive Health for Ladeez (GURHL) Code, an SRH web-app for Black and Latina women aged 18 to 25 in an urban area. The description includes how this project incorporated divergent thinking into the development process.

PREVIOUS WORK AND GURHL CODE DEVELOPMENT

GURHL Code was a randomized 2-group pilot study to test the feasibility, acceptability, and preliminary efficacy of a smartphone web-based application (meaning a website that works across multiple devices [smartphones, tablets, etc.]) to promote connection to clinical services and to improve sexual health knowledge. To develop GURHL Code, an advisory committee was
convened, formative focus groups were conducted, a web-based application (web-app found at gurhlcode.org) was created, and a pilot randomized controlled trial (RCT) with web analytics, baseline, and post-test survey data collection 3 months later, and follow-up focus groups were conducted. (see Figure 3 for a study timeline). The web-app (GURHL Code) development is discussed in this chapter, recruitment for the RCT is discussed in Chapter 2; the feasibility and acceptability of using a web-app for SRH research is described in Chapter 3; and the preliminary efficacy of the pilot RCT is discussed in Chapter 4. Finally, Chapter 5 summarizes findings from Chapters 2 through 4 and discusses strengths and limitations of the study as well as recommendations and future research directions.

**Community Advisory Committee (CAC) (March 2013 to May 2016)**

Finding mentors and a team is critical when working on a technology-centered project. This core group of people can offer advice, guidance, and critical feedback that are helpful in continuing with the project and seeing it through to fruition. A Community Advisory Committee (CAC) was convened in March of 2013 and was comprised of intended users of the web-app in this study (i.e., women aged 18 to 25 living in New York City who self-identified as Black \([n = 4]\) and/or Latina \([n = 2]\)) and of content area experts (i.e., 4 adult providers representing 3 community-based agencies and 1 independent researcher who provided services for the target population for a minimum of 5 years. The adult providers had an average of 13 years of experience working with young people between 13 and 25 years old in the sexual and reproductive health field in New York City.). The CAC met via video conferencing 12 times over the course of the project with additional sub-committee work (e.g., individual and small group meetings with the PI to explore recruitment strategy and to provide input on design). In addition, communication was conducted via email and texting. CAC members reported that they
were drawn to this project for various reasons: the opportunity to work collaboratively on an innovative technology-based project; the opportunity to engage with and meet new researchers, young people, and practitioners; and the opportunity to help shape a much-needed public health web-app. CAC members provided a feedback loop on early iterations of the wireframes, the web-app content and design, study logo development, and name. Throughout the process, the CAC shared resources such as presentations about current sexual and reproductive health web-apps (i.e., Youth Health 2.0, 2011). Although the CAC was an essential source of feedback for developing GURHL Code, there were several interconnected elements of this project that resulted in an iterative development process: the technical development and program development through focus groups were interconnected and informed which steps or cycles had to be repeated (Figure 4). It was through these approaches that the final content and web-app design were developed. As an example, the web-app name, GURHLCode, which was a play on the popular MTV show¹³⁸ came out of several brainstorm sessions with CAC members over email and then was refined through follow-up discussions.

**Formative focus groups (August 2013 to November 2013)**

Between August and November 2013, 5 focus groups with a total of 29 participants were conducted to inform the content and cultural relevance of the SRH web-app, gurhlcode.org. Focus group participants identified as Black \((n = 27)\) or Latina \((n = 2)\), 62% of participants were between 18 and 20 years old, 48% were currently in college, and the next largest group had completed high school or earned a GED (28%). All respondents owned a smartphone and used web-apps. Formative focus group participants received $20, and a round-trip metro card (reimbursement for public transportation); food and beverages were also provided.
The CAC assisted with identifying participants for formative focused groups, drawing from their community connections. This resulted in 11 organizations announcing the focus group opportunity with their constituents via fliers, email announcements, and through social media (i.e., Facebook) throughout Bronx, Manhattan, and Brooklyn—including areas with high rates of sexually transmitted infections and HIV. However, in spite of these recruitment efforts, no focus group participants in the target age group (ages 18 to 25) were generated. This was likely due to difficulty enrolling participants during the summer months as many programs operated on an academic calendar and because only a few programs maintained contact with alumni who were over 18 years old.

Eventbrite.com, an online event forum that makes tickets available that can be used to plan, manage, and promote events, was also used to recruit formative focus group participants. A single event page was created and participants could select 1 of 3 date options to offer 3 different focus group dates for which young women could register on their own. It was sent to CAC and community contacts and all were asked to share with their networks appropriately. This form of recruitment through targeted community organizations and through participants sharing the focus group opportunity on social media yielded 17 eligible participants. Recruitment for 2 additional focus groups was conducted in collaboration with 2 community-based organizations and held at their sites at 2 separate locations in Brooklyn. These additional connections were made through the CAC.

I served as moderator and there was one additional note taker during all formative focus groups in which we explored: the preferred content, tone, and design for the SRH web-app in development; wireframes or sketches of the web-app; beta version web-app usability; and different scenarios in which participants might find themselves using the SRH web-app.
Participants were initially asked during focus groups what type of content they would prefer to see in a sexual health education web-app (i.e., information, clinic finder, etc.). Then, in small groups of 3 to 5, participants sat in front of a computer and reacted to wireframe sketches. Figure 5 demonstrates an example of the main menu; other pages included typical STD symptoms and what one should do for each symptom, and a connection to a personal health educator with contact information for Planned Parenthood and The Door in New York City. Clarifying questions were asked as participants went through the different screens. Between 3 and 5 volunteers from each focus group then downloaded a beta version of the web-app on their phones for the beta version usability testing. Although the intention was to have the volunteers be the sole testers of the web-app, in several groups others asked if they could participate in the usability testing as a group—an important reminder of the shareability of web apps. Participants were presented with different situational scenarios in which they might find themselves using the web-app (e.g., “A cousin came to you with complaints of painful urination, how might you use the app to help them?”). Focus groups included usability testing by allowing individuals from the target population to test an early version of the web-based application to ensure a user-centered design and a culturally relevant focus. Their experience with the web-app was used to identify usability issues such as the need to make modifications to the menu, including personalized It Happened to Me stories, and adding a rotation of positive affirmations (e.g., “You are beautiful, let’s talk about how to take care of you.”) mixed in with STD statistics that appeared upon opening a new page. Usability testing techniques were also implemented by taking input and by having different groups react to slightly more developed wireframes, a process known as rapid prototyping.126,133
We then conducted content analysis of the notes captured at each focus group by the note-taker and listened to the focus group audio recordings. Thematic codes were checked to ensure accuracy by a separate code-checker. Focus groups revealed both interest and need among the target population for a sexual health web-app. Participants shared that they were capable of conducting an Internet search or of asking a friend or parent for information on their own, but there were pitfalls with those approaches: “If you just Google something, sometimes, some of the information you get is wrong. Or if you ask your friends, they don’t know…a lot of times, parents don’t know...” The notion of a one-stop shop for sexual health information arose: “[I] want a single app that includes everything—[I] don’t want to keep moving from one app to another. [We] want one trusted resource without traveling too much ‘cyber-space wise.’”

Thematic analysis suggested that young women of color were eager to utilize the privacy that mobile phone web-apps provide to explore credible SRH information in an easily accessible and easy to understand format. One focus group participant said,

I also believe this would be a very useful app. … I just have to say you found the real need and I think the app would be really great because young women, especially those of color, they don’t have the support services they need, so this is just one thing in the big circle of things that they need, but it’ll be really helpful for them to have—just women [as] a whole. I like it, and if this is just a pilot, I hope it goes to older women, and younger women, and just goes out there. (Focus groups, 2013; New York City). Another participant said,

Specific needs include information with a focus on sexually transmitted infections, overall healthy reproductive self-care, and connection to clinical services. The most important thing … is the thing about the clinics. Like you could have all this
information, but you have to have girls go out and seek help, and they aren’t going to seek help unless they have the information there … and clinics, free clinics, and insurances ‘cuz they are scared to go if they are under their parents’ insurance. (Focus groups, 2013; New York City).

Regarding the web-app tone and approach, participants shared that they wanted the tone to be straightforward, easy-to-understand, and non-judgmental. One participant shared, “Don’t promote abstinence, or talk badly about abortions. [It] shouldn’t give feeling that there is a hidden agenda or promoting anything—just providing the facts. The app should have the attitude like ‘You are free to do whatever you want to do, here is some information along the way.’ ” Participants were also explicit about avoiding scare tactics. One participant said, “Don’t lie, you know what I’m saying? Don’t say, ‘If you have sex, this is going to happen.’ Don’t do that…[because] after a while they will question, like, ‘Is the possibility really that high?’ ” Another participant phrased it another way, “Don’t scare people like, ‘If you do this, you’re gonna get this and you’re gonna die.’ ” As a result of this input, we aimed to present information in the web-app honestly and directly, while intentionally avoiding fear-based tactics, specifically around the STD content. In addition, respondents also provided usability and interface-design input to keep the design “clean.” Finally, a recurring theme was that, “No one wants to read a lot,” so we aimed to keep the content concise yet informative, covering several content areas pertaining to finding a clinic and sexual health knowledge.

**Description of intervention condition**

The GURHL Code web-app content was informed by the PI’s 15-year career in public health, the community advisory committee (CAC), and formative focus group feedback. Content was also provided by Bedsider, a program of The National Campaign to Prevent Teen and
Unplanned Pregnancy, to provide users with a list of clinics by providing clinic names, a brief description of ages and specific populations served, hyperlinked telephone numbers, clinic websites, and a link to “find on Google Maps,” and physical addresses. All hyperlinks were active so that users could click a button and then have the links open in another app on their phone (e.g., the telephone link would generate a pop-up prompt asking if the user wanted to use an app already installed on their phone or computer to dial that number). Similarly, clicking the geo-location link would automatically open the link in Google Maps. Ibis Reproductive Health, an international clinical and social science SRH research nonprofit organization, gave permission to use their “Answering Difficult Questions: A Guide to Address Young Women’s Sexual Health Concerns,” a resource intended for assisting health care personnel in responding to young women’s concerns around sexuality and sexual health. National Planned Parenthood of America provided code to link participants to their web-based feature to chat (similar to a texting session) with a national health educator. The web-app was coded using HTML, CSS, PHP, and Javascript on a WordPress mobile-friendly website. Content was then refined after pretesting the web-app with a national sexuality trainer and a local physician for adolescents (see Figure 6). The intervention arm received this web-app as an interactive sexual and reproductive health (SRH) responsive web page that functioned as an app on an iPhone or Android smartphone. Content areas are described in Table 1.

**Description of control condition**

The control condition was also a web-app developed in HTML and CSS on a WordPress mobile-friendly website and was similar to the intervention web-app. It functioned as an app on an iPhone or Android smartphone after it was bookmarked to the home screen. However, the content of the control website was a “flier on the web” and served as the standard of care (see
Figure 7). It contained information that had been prepared and disseminated at health fairs in New York City. It listed clinics’ telephone numbers, physical addresses (with cross streets), websites, if available, by borough, and had a long-page website design. The control website also included a list of trusted websites, and a form to contact clinics was provided at the bottom of the page. With the exception of the “send” button on the contact form, no information on the static page had live hyperlinks.

OVERVIEW OF THE DISSERTATION

Data for this dissertation were collected from June to December 2015 among Black and Latina women aged 18 to 25 in New York City. The sample included participants who self-identified as either Black or Latina women aged 18 to 25, who owned a smartphone, who were living or working in New York City, and who reported vaginal or anal intercourse with a male partner in their lifetime. In total, 114 Black and Latina women aged 18 to 25 years in New York City were enrolled and 105 women completed the intervention, a 92% retention rate. Of the 61 participants allocated to the intervention arm, 57 (93.4%) compared to 48 (90.6%) in the control arm completed the 3-month follow-up assessment. The study period was from October 7, 2015 to April 14, 2016 and 4 optional focus groups were conducted between April 18, 2016 and May 15, 2016 (intervention group, n = 6, control group, n = 7). Of note, only 2 participants were excluded due to not owning a smartphone, suggesting it is feasible to conduct a smartphone study for this target population.

For Aim 1, we describe the sample and compare women who ultimately enrolled in the research study (n = 110) to those who were eligible but chose not to enroll (n = 46) on age, race, relationship status, education, individual income, employed status, insurance status, condomless sex acts in their lifetime, number of male sex partners in their lifetime, age of oldest male sex
partner, and age of first sexual intercourse using t-tests or chi-square tests as appropriate. Aim 2 ($n = 105$) assesses the feasibility and acceptability of the web-based application created for this dissertation with focus group results ($n = 4$) triangulated with baseline, post-surveys, and analytics results. We compared the treatment arms on demographics, health risk behaviors, understanding of other applications, usability items, and web analytics using t-tests, chi-square tests, or Fisher’s exact tests, as appropriate. We conducted focus groups by study arm, thus reporting thematic findings by intervention and control group. Aim 3 ($n = 105$) compared treatment arms on demographics, health risk behaviors, understanding other web-applications, linkages to sexual and reproductive health services and knowledge using t-tests, chi-square, or Fisher’s exact tests, as appropriate. All statistical analyses were performed using SAS 9.4 software. All procedures were reviewed and approved by the City University of New York Institutional Review Board (protocol # 381039).

This is a feasibility and acceptability study building on a National Research Service Award (F31MH099924 Gonzalez, S.). The specific aims of this dissertation are:

**Aim 1:** Using recruitment data: a) compare those who were eligible for the study and enrolled to those who were eligible and did not enroll in the GURHL Code study; and b) drawing from self-report data, compare the cost-per-enrollee per recruitment source.

**Aim 2:** In comparison to the control arm, determine the tailored web-app’s usability (e.g., ease of use, content, and design) through: a) analytics (e.g., number of times information was accessed and duration of page visits on respective modalities), b) process measures, and c) focus groups.
**Aim 3**: Obtain preliminary estimates of the effectiveness of the web-app in the treatment arm versus control arm over 3 months to increase: a) sexual health knowledge, b) intention to connect to sexual and reproductive health clinical services, and c) self-report linkages to SRH services.

**Hypothesis**: At 3 months, compared to the control group, those in the treatment group will have more self-reported connection to clinical services, better knowledge of SRH education domains and of how to link to SRH services (e.g., PREP, PEP, EC, birth control, HIV, STD, and pregnancy testing). The primary outcome of this study, self-reported utilization of SRH services and SRH knowledge will be assessed using a survey comprised of validated structured items at baseline and at 3-month follow-up via computer-assisted self-interview (CASI) software. Analysis will compare differences between the two arms. Findings will provide information on preliminary efficacy and will be used to generate adaptations for future studies.

**Public health significance**

This study has strong public health merit. If successful, this work will inform future large-scale theory-driven studies about the benefits and limitations of SRH web-apps for young adult Black and Latina women in urban environments. Mobile health (mHealth) use is proliferating; the CDC and public health researchers acknowledge SRH web-apps as important potential tools to facilitate young people’s access to services and to reduce young women’s sexual risk. This dissertation has the potential to build a foundation for larger scale innovative behavioral interventions and to positively impact various populations quickly and effectively by exploring whether this research can be executed (feasibility) and whether the components of the main study work together.

The GURHL Code web-app, co-developed with the population of interest and with allies, could offer education on areas that are difficult for young women to raise and for clinicians to
address, influence risk perception, offer insights on proper condom use, and offer connection to an appropriately trained SRH health educator who could address the SRH needs of young Black and Latina women. In addition, the demographic minority–majority shift that is expected by 2050 offers scientific rationale for adequate minority representation in all types of studies to ensure generalizability of findings and the applicability of findings to diverse populations. Although a systematic review found that 11 studies reported the use of media and social marketing techniques tailored to the target audience, the authors note that these studies failed to provide details on the most effective medium with different samples.

This dissertation fills a number of gaps remaining in sexual mHealth research: 1) There is an ongoing need for increased young people of color participating in public health research. 2) As health-technology continues to grow, the field needs to understand the benefits and limitations to on and off-line recruitment. 3) This dissertation additionally contributes to the growing body of STD, including HIV, public health technology literature by exploring the feasibility and acceptability of this web-based application specifically tailored for Black and Latina women aged 18 to 25.
Figure 1. Study Conceptual Model. Factors impacting SRH knowledge and clinic utilization used to develop the GURHL Code web-based app. Adapted from Bandura A. Health promotion from the perspective of social cognitive theory (2012)

**ENVIRONMENTAL FACTORS**
- Poor access to SRH healthcare (due to being on parents’ health insurance or lacking health insurance)
- Complicated US healthcare system
- Culturally incompetent staff and service providers at SRH clinics
- Transportation barriers

**COGNITIVE FACTORS**
- Misconception of prohibitive cost or billing for SRH services
- SRH knowledge \(\rightarrow\) clear and easy to understand language throughout
- Confidence in ability to perform tasks (i.e., condom usage, scheduling and attending SRH appointment) \(\rightarrow\) clinic search with Google Maps, simplified list of things to bring to a SRH appointment
- Shame and stigma around STD diagnosis \(\rightarrow\) STD diagnosis rates among young people and explanation
- SRH expectations and attitudes
- Self-efficacy to negotiate safer sex and STD testing

**BEHAVIORAL FACTORS**
- Proper condom skills and consistent usage \(\rightarrow\) pictures and written instructions on condom usage, “Did you know?” questions on condom usage
- Ability to schedule and keep SRH clinical appointment \(\rightarrow\) clinic search with Google Maps link, what to bring to the clinic
- Sexual relationships
- Serial monogamy
- Biological predisposition for STDs
Figure 2. Design Thinking Approach and Social Cognitive Theory Interplay

- **Empathize** — learn about audience
- **Define issue** based on user needs
- **Ideate** — brainstorm creative solutions
- **Prototype** design
- **Test product**

**ENVIRONMENTAL**

**BEHAVIORAL**

**COGNITIVE**
Figure 3. GURHL Code Study Timeline

- Mar 13–May 16: Community Advisory Committee (CAC) formed & consulted
- Aug 13–Nov 13: Conducted formative focus groups
- Jan 15–Apr 15: GURHL Code finalized for RCT
- Jun 15–Dec 15: Recruitment & enrollment for RCT
- Feb 16–Apr 16: Follow-up post-test for RCT
- Apr 16–May 16: Follow-up focus groups for RCT
Figure 4. Iterative Public Health Intervention with Technical Component and Community Input
Figure 5. Wireframe for Formative Focus Groups Example
Figure 6. Intervention Condition Screenshots
Figure 7. Control Condition One-Page Screenshot

Easy to Understand & Trusted Web Sites

- Ask Alice: greeninfo-columbia.edu
- NYS BOCES: nysboces.org
- Planned Parenthood: plannedparenthood.org
- NYC Condom Finder: http://nycdohcondoms.com
- New York Health Exchanges: newyorkhealthexchanges.org
- Medline Plus: https://medlineplus.gov/sperm

There are lots of other options. These are just a few places where we think you might have a good experience for your sexual and reproductive health. If we’re wrong, please send us a note using the form at the bottom of the page.

Brooklyn
HSAF Program
718-627-4446
Free and confidential reproductive & sexual health services ages 13-24 years old
Nursing.org
470 Flatbush Ave, 3rd Floor, 3rd Floor, Brooklyn, NY 11203
Planned Parenthood Brooklyn
1-800-230-PLAN
plannedparenthood.org
44 Court St, 8th Floor, Brooklyn, NY 11201

Bronx
Adolescent Clinic at Children’s Hospital of Montefiore Medical Center
718-441-5495
chain.org/locations/addresses/
3411 Stanford Ave, 4th Floor, Bronx, NY 10467
Community Healthcare Network’s Tremont Health Center
718-294-6981
chcnyc.org/locations/locations.html
3411 Stanford Ave, 4th Floor, Bronx, NY 10467
Institute for Family Health – Mount Hope Family Practice
718-955-9000
130 East Tremont Ave, 1st Floor, Bronx, NY 10465
Planned Parenthood Bronx
212-928-1500
plannedparenthood.org/locations/new-york/bronx
341 E 166th Street, 1st Floor, Bronx, NY 10451
Urban Horizons Family Health Center
718-220-3000
80-05 East 169th St, 1st Floor, Bronx, NY 10453

Manhattan
Gullen Lourie | Health Outreach to Teens (HOTT)
LGBTQ adolescents and young adults’ medical and mental health program targeting homeless youth
212-271-0100
mallowie@nyc.gov
### Table 1. GURHL (Guide to Understanding Reproductive Health for Ladeez) Code Content

<table>
<thead>
<tr>
<th>Code Content</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinic Finder and Trusted Resources</strong></td>
</tr>
<tr>
<td>An option to search for nearby clinics using a database maintained by Bedsider (National Campaign to Prevent Teen Pregnancy) for a list of health centers and birth control providers. Information includes hyperlinks and clickable information that can then be opened using other web-apps and websites such as telephone numbers, and geo-location maps.</td>
</tr>
<tr>
<td><strong>Things for the Clinic Visit</strong></td>
</tr>
<tr>
<td>A simple list of items needed for a clinic visit, including items one may need if asking for financial assistance.</td>
</tr>
<tr>
<td><strong>Text an Expert</strong></td>
</tr>
<tr>
<td>An option for a participant to connect to a National Planned Parenthood health educator.</td>
</tr>
<tr>
<td><strong>It Happened to Me</strong></td>
</tr>
<tr>
<td>Two audio stories by a woman and a man about how they contracted HIV as young adults and are living with HIV in NYC.</td>
</tr>
<tr>
<td><strong>STDs—Let’s Get Real</strong></td>
</tr>
<tr>
<td>Clear and medically accurate information on STDs.</td>
</tr>
<tr>
<td><strong>Questions, Honest Answers</strong></td>
</tr>
<tr>
<td>Questions and answers created by Ibis Reproductive Health in order to assist health care personnel to respond to young women’s concerns around sexuality and sexual health.</td>
</tr>
<tr>
<td><strong>Condoms</strong></td>
</tr>
<tr>
<td>An educational website that provides information on how to properly put on a condom which includes both text descriptions and pictures of male and female condoms. It also directs users to where they can find free condoms in NYC.</td>
</tr>
<tr>
<td><strong>My Parts</strong></td>
</tr>
<tr>
<td>A basic educational video on reproductive female and male anatomy.</td>
</tr>
<tr>
<td><strong>Who the heck made this app?</strong></td>
</tr>
<tr>
<td>A brief description of how the web-app was made and by whom.</td>
</tr>
<tr>
<td><strong>Did you know?</strong></td>
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<tr>
<td>Rotating factoids on STDs and self-empowerment quotes and messages at the top of each page.</td>
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CHAPTER 2—Recruiting Young Women of Color into an HIV Prevention Pilot RCT:
Lessons Learned and Implications for Health Technology Applied Research

Target Audience: Public Health audience (STD/HIV researchers)

ABSTRACT

Young Black and Latina women suffer from higher STD incidence than White women, increasing their susceptibility to contracting HIV. Eligibility requirements for the research study included self-identified Black or Latina women aged 18 to 25 who owned a smartphone, were living or working in New York City, and who reported vaginal or anal intercourse with a male partner in their lifetime. The study compared those who enrolled in the research study to those who were eligible but chose not to enroll on age, race, relationship status, education, individual income, employment status, insurance status, condomless sex acts in their lifetime, number of male sex partners in their lifetime, age of oldest male sex partner, and age of first sexual intercourse. Comparisons were made using t-tests, chi-square, or Fisher’s exact tests as appropriate. In addition, drawing from self-report data, the study compared the cost per enrollee by recruitment source. Recruiting via college professors through emails and college LISTSERVs was more effective than recruiting via Facebook banner advertisements. Data on the banner ads and the findings reported by enrollees both revealed that potential enrollees responded more favorably to banner ads that included the study logo and images of women, rather than the logo alone. Women who enrolled in the GURHL Code study were more likely to report an income below $20,000, and to be working or to be a student than were the women who were eligible but did not enroll.

BACKGROUND
In the United States, young Black and Latina women experience higher rates of sexually transmitted diseases (STDs), including HIV, compared to White women. In 2016, the chlamydia rate in the United States among Black women was 5.7 times the rate among White women, 1432.6 and 253.3 per 100,000 women, respectively. Trend data in New York City between 2000 to 2013 showed Black women aged 18 to 25 had the highest chlamydia incidence compared to all groups, including groupings by gender, race/ethnicity, and 5-year age groups. Women’s increased STD risk increases their susceptibility to HIV transmission and can lead to long-term reproductive complications such as infertility. These data highlight the need to continue conducting research to understand better the factors that contribute to STDs among young Black and Latina women.

Mobile phones are a common and vital part of our communications systems. Since 2011, when the Pew Research Center began collecting smartphone ownership data, there has been a nearly 2-fold increase in cell phone ownership. In 2015, 92% of American adults owned a mobile phone, 68% of those same adults were smartphone owners. Young people of color were as likely as their White counterparts to be smartphone adopters. A 2015 report indicated that 86% of 18- to 29-year-olds owned a smartphone; in addition, equal proportions of Blacks (68%), English-speaking Latinos (64%), and Whites (66%) owned a smartphone. The increased accessibility of smartphones has provided easy and constant access to social networking and online dating websites for many people, including women users. At the moment, Facebook is the most popular social media platform with 79% of Americans online using Facebook; 83% of US female online users, 75% of male online users, and 88% of Internet users aged 18 to 29 are Facebook adopters.
The ubiquity of web access has allowed HIV and STD researchers to recruit study participants using individuals (i.e., seeds) on social media\textsuperscript{56,84,153–155} with a wide range of hidden populations including men who have sex with men (MSM),\textsuperscript{156–159} drug-using populations,\textsuperscript{160} and homeless\textsuperscript{161} populations from various Internet websites, including Craigslist and Facebook.\textsuperscript{56,162–164}

Specifically, health-technology research among young people has ranged from focus on hookah\textsuperscript{39} and tobacco smokers,\textsuperscript{164} alcohol advertising and consumption,\textsuperscript{165} and prescription opioid misuse\textsuperscript{40}—all were cross-sectional studies and included a variety of recruitment strategies including Facebook ads, street intercepts, Craigslist advertising, and university campus flyers. Several nutrition and diet studies successfully used social media recruitment strategies targeting adolescent women:\textsuperscript{154,166,167} two of these studies were in Australia; \textsuperscript{154,167} a third study was conducted in Pennsylvania and had a target age of 18 to 45.\textsuperscript{166} Nutrition and diet studies have successfully used social media to recruit participants, however, these health issues tend to be less stigmatized than sexual and reproductive health. Another key difference between these studies and the one discussed here is the lack of comparison between social media and other approaches. Leonard and colleagues did not compare recruitment between their 3 studies due to differences in degree of burden and incentives across studies (study designs also differed across all 3 studies).\textsuperscript{167}

Facebook ads have most successfully recruited participants for cross-sectional (one-time or weekly) studies including: young adults, trans-women, college students, adult women, and MSM.\textsuperscript{39–46,168} MSM studies in particular have reported drawing large samples for cross-sectional studies using online approaches, including Facebook banner ads. For example, a cross-sectional study of HIV-positive participants generated 1221 individual completed surveys from social media, including Facebook.\textsuperscript{45} Banner ads were used on Facebook in Australia to recruit women
aged 16 to 25 for a cross-sectional study. Of note, Leonard and colleagues only utilized the university Facebook page for recruitment for the RCT study and a broader social networking website for a cross-sectional study; thus, highlighting the importance of matching the appropriate recruitment approach with study design with particular attention to study duration (RCTs last longer than a cross-sectional one-time survey). Longitudinal studies such as the Just/Us study relied on a combined on- and off-line approach to recruit their sample of 1578 diverse youth aged 16 to 24. Nelson and colleagues initially used Facebook banner ads to recruit women for an online one-time survey and asked participants whether they would like to be contacted for future HPV-related studies. In this way, they were able to enroll 300 participants into a longitudinal study that included collecting a self-specimen for HPV.

Sexual health-technology research among young women of color (YWOC) is an emerging area. Unlike technology-delivered interventions focused on other populations, such as MSM studies, a review of the use of technology for HIV prevention among adolescent and adult women found that the Internet or other social media platforms were infrequently utilized. Rather, young women were typically recruited from in-person clinical or community sites with the exception of combining a Craigslist.org ad with other in-person approaches. In several recent reviews outlining the current state of the literature of technology-delivered HIV interventions (between 2011 and 2015), ten focused on adult women of color versus 32 focused on other populations; out of the 10, four were identified as including young adult women of color between 18 and 29 years of age (see Table 1). Among those identified in which the focus was on YWOC, 2 recent sexual and reproductive health (SRH) computer-delivered HIV prevention studies targeting women for intervention included one using Craigslist ads amidst a variety of brick and mortar (i.e., clinical and community-based) sites to recruit participants;
however, the researchers did not describe in detail which approach was more effective.\textsuperscript{48,49} In 30 days, Jones, Lacroix, and Nolte, enrolled 40 women, 39 of whom completed a 1-month follow-up survey to evaluate the acceptability of a guide-enhanced HIV prevention soap opera video series; 20 were Black, 12 were Latina, and 5 were White.\textsuperscript{84} In addition, the literature review yielded only 1 study that presented data on those who did not enroll (based on screening data) in a sexual and reproductive health and technology-based study and who were recruited via the Internet.\textsuperscript{169} Nelson and colleagues report women who enrolled in the study were similar to those who did not enroll on the following characteristics: age, race, education, and HPV vaccination status. However, no test statistics are reported, only descriptive statistics.\textsuperscript{169} There is a dearth in understanding of how banner ads might be utilized to recruit women and sub-populations among women (i.e., Black and Latina women).\textsuperscript{50}

Given the limited data on recruitment among Black and Latina women, this paper describes the recruitment process for a web-based pilot RCT among Black and Latina women aged 18 to 25 years in New York City. This study examined demographic and behavioral characteristics of those who were eligible and who enrolled into the GURHL Code study compared to those who were eligible and began the screening survey but who did not enroll in the study. Effectiveness by recruitment source was also explored.

METHODS

Participants and procedure

Data for this study were taken from GURHL (Guide to Understanding Reproductive Health for Ladeez) Code, a randomized 2-group pilot study to test the feasibility and preliminary efficacy of an online smartphone application tailored with and for Black and Latina women aged 18 to 25 in New York City. The intervention consisted of a web-based application to promote
connection to clinical services and to improve sexual health knowledge. To help ensure cultural relevance, a community advisory committee was consulted to finalize the look, feel, and content of each form of recruitment (banner ads, recruitment emails, fliers). The development of the web-based application and more details on the community advisory committee are described in Chapter 1. To be eligible, participants had to: be women between 18 and 25 years old; self-identify as either Black and/or Latina; own a smartphone (i.e., a phone capable of accessing the Internet); live or work in NYC; and have reported vaginal or anal intercourse with a male partner in their lifetime. Exclusion criteria were selected to eliminate potential subjects in circumstances that could increase a participant’s use of sexual or reproductive health services. These included being pregnant, or having children 2 years old or younger. Other exclusion criteria included only being sexually active with women, or being unable to read English. (Among Spanish speaking Latinos in NYC, 71% reported speaking English well or very well, while 29% reported speaking English less than “very well” \( n=535,798 \).\textsuperscript{172}) Regardless of recruitment source, all participants were directed to an initial online screening survey. All procedures were reviewed and approved by the City University of New York Institutional Review Board (protocol # 381039).

**Recruitment strategy**

Women were recruited via passive paid online banner ads on a social network website and an online dating website, targeted electronic outreach (e.g., emails to community-based organizations and to professors at local colleges), and a free events website, Eventbrite, an online self-service ticketing platform where individuals, businesses, and organizations plan, manage, and promote events. The website makes tickets available to others, and can collect payments for upcoming events when applicable. However, given that only 7 women began a screening survey who came via Eventbrite, all future discussion in this paper will exclude this recruitment source.
Recruitment fliers and banner ads included the study logo, study description (i.e., using a sexual health app on a smartphone for 3 months, post-test, optional follow-up focus group), possible $70 for participating in all research components, and directed participants to the online screening/eligibility survey.

To complete enrollment in the pilot RCT, participants submitted a screenshot of the web-app saved as a bookmark on their phone to the study email address or study phone number. Research staff followed up via text or phone with participants who had completed the survey but who failed to send a screenshot. For this pilot, participants were randomized after being screened, providing consent, and completing their baseline assessment. In the baseline survey, participants were asked how they heard about the study. In total, 114 Black and Latina women aged 18 to 25 years in New York City took part in the study.

**Online recruitment procedures**

We purchased Facebook and OkCupid banner ads and, for each ad, 1 of several images was used (see Figure 1). The OkCupid ad ran for a total of 10 weeks. We obtained the rights to use stock photographs from a stock photography Internet website. In addition, an electronic announcement was posted on Eventbrite. Utilizing the banner ad builder for both Facebook and OkCupid, we tailored the population who would see the banner ads. Facebook selection allowed for a more refined selection for a potential reach of 99,000 people. Prior research shows that young people typically enter their full name, facial pictures, and hometown in their profiles, and that they do so accurately. The selection criteria for both OkCupid and Facebook included gender and geography. Facebook additionally offered the ability to select the audience that would see the ad by relationship status, interest in men, age range, and language (see Table 2).
Targeted electronic outreach

An email was sent to faculty and staff at local colleges (n = 142) and community-based organizations in New York City (n=25) in which the PI introduced herself and the project, included a description of the study and a recruitment flier to forward to students and other faculty or staff; the email and attachment included a hyperlink to the online screening survey. Professors were asked to forward the email with the attached recruitment flier to students directly (i.e., to post it on an online course management system or on a class website), and/or to hand it out in class. The majority of professors who were sent an email were teaching courses related to the content area of this study (e.g., human sexuality, women’s studies, psychology, public health, or interactive technology and pedagogy) at any of the 24 City University of New York colleges (CUNY). CUNY is the nation’s largest urban university and is a unique slice of the NYC population with a lower income status (2 out of 5 students live in households that earn less than $20,000 per year), and represents a highly diverse population (in 2015 the enrollment was 30% Hispanic, 25% White, 25% Black, and 20% Asian/Pacific Islander). Two school LISTSERVs at the CUNY School of Public Health and the CUNY School of Social Work and 7 CUNY-wide programs and clubs did a mass distribution to their students; thus, the number of emails sent to faculty and staff could be higher than our estimation. Emails were also sent to community-based organizations (CBO) serving young women of color that had an alumnus list. These organizations were also asked to forward the email with the attached recruitment flier and to print and post the flier in a visible place at their CBO. We generated a bit.ly link to capture the number of clicks when a professor sent a flier to students, and in turn, when students clicked on the fliers they received.
Analytic plan

Sample characteristics

We compared those who ultimately enrolled in the research study \((n = 110)\) to those who were eligible but chose not to enroll \((n = 46)\) on age, race, relationship status, education, individual income, employed status, insurance status, condomless sex acts in their lifetime, number of male sex partners in their lifetime, age of oldest male sex partner, and age of first sexual intercourse using \(t\)-tests, chi-square or Fisher’s exact tests as appropriate.

Recruitment approaches

Next, we report on web analytics, differentials of friend referrals, and cost-per-enrollee by recruitment source to evaluate recruitment approaches. To compare the different individual images used banner ads, the following measures were used: impressions, clicks, and cost. An impression is defined as instances when a banner ad appeared on a user’s Facebook or OkCupid page regardless of whether the banner ad was clicked or not. A click was counted when a user clicked on the survey link and was then taken to the landing page for the online survey. The number of clicks per impression and those enrolled were compared between the online approaches (Facebook and OkCupid) to explore how many clicks yielded a single enrolled participant, how many impressions it took to generate a single enrolled participant, and the number of clicks on impressions by online recruitment source (Facebook and OkCupid), which were then analyzed using a Fisher’s exact test. The cost-per-enrollee was calculated by the number of clicks divided by the cost to display the ads. The cost for targeted electronic outreach recruitment was determined by the person-hours spent on recruitment efforts such as posting fliers in physical spaces, and sending out recruitment emails. Chi-square or Fisher’s exact tests were used as appropriate to compare the number of screening surveys, number of eligible
participants, and number of enrolled participants by the Facebook and targeted recruitment sources only as no respondents completed screen surveys who were enrolled by Eventbrite or OkCupid.

**Banner advertisements**

Ads were then compared based on analytic metrics including impressions and clicks. We then calculated a click-through rate, defined as the number of clicks on advertisements per impression. The percentage is the number of people who viewed the impression and then clicked on the ad where a higher percentage indicates a high percentage of people who saw the ad and clicked on it. Chi-square was used to compare impressions between the 3 groups: logo only, an ad with an image of only a Black woman, and a third ad including an image of only a Latina woman. All statistical analyses were performed using SAS 9.4 software.

**RESULTS**

**Recruitment, enrollment, and retention**

Recruitment, enrollment, and retention data are illustrated in Figure 2. In total, 583 participants visited the landing page of the screening survey, of which 492 consented to proceed with the baseline survey (84.4%). Forty-nine percent of those consenting \( n = 243 \) did not complete the screening survey in full (i.e., closed their browser window, usually very early into the survey process) and 18.5% \( n = 91 \) were ineligible for the study. Participants were deemed ineligible for any one of the following reasons: 89 (18.1%) were not between 18 and 25 years old, 76 (15.4%) were neither Black or Latina, 33 (6.7%) had participated in a peer sexual health education program of 10 weeks or longer, 34 (6.9%) neither lived nor worked in New York City, 20 (4.1%) had children under 2 years old, 18 (3.7%) were male, 6 (1.2%) were pregnant at the
time they took the screening survey, and 2 (0.4%) were ineligible for the study due to not owning a smartphone.

Of the 156 eligible participants, 28.5% (n = 140) provided consent to complete the baseline survey, while 3.2% (n = 16) were eligible for the study but did not provide consent to continue with the study. Of the 122 eligible women who completed the baseline survey, staff was unable to reach 8 women to complete all enrollment steps. The remaining 114 women completed all enrollment steps and were randomized into the controlled trial pilot (n = 61 intervention, and n = 53 control); the randomization process and the characteristics of the study population by study arm are presented in Chapters 3 and 4.

Demographic Characteristics

Those enrolled in the study reported significantly lower incomes and had significantly less education than those who chose not to enroll (see Table 3). Those enrolled in the study were more likely to report an individual income below $20,000 (78.2%), compared to those who did not enroll (37.0%) who had an even distribution of incomes between <$20,000 and $20,000 to $49,000 (32.6%) ($^2 = 7.8, p < 0.01). No one, either those who enrolled or those who chose not to enroll, reported an income above $50,000. Those enrolled in the study also tended to be working or to be a student compared to those who did not enroll in the study (90% versus 59%).

Table 3 displays demographic characteristics of women enrolled in the study (n = 110) compared with those who were eligible but did not enroll in the study (n = 46). Enrollment status did not significantly differ by age (Mean age = 22 overall), race/ethnicity, or relationship status.

Enrollment status did not significantly differ by mean age of first sex—enrolled $M (SD) = 17.1 (2.7)$ versus not enrolled $M (SD) = 16.2 (2.9)$, condomless sex in lifetime (88.2% among enrolled versus 52.2%), or number of male sex partners in lifetime (61.8% among enrolled and
26.1% among not enrolled reported between 1 and 5 partners, and 29.1% of those enrolled compared to 21.7% among those not enrolled reported between 6 and 15 partners).

**Data by recruitment source**

First, we compared the cost in dollars spent per participant enrolled by recruitment sources, as well as the number of impressions needed to yield an enrolled participant. Of note, 130 participants did not indicate their recruitment source and were thus excluded from these analyses; as a result, totals do not add up to the final number of participants recruited and enrolled. A total of $704.75 was spent on Facebook ads, generating 275,332 impressions and 1,986 clicks ($0.35 per click) with a 0.72% click-through rate. This resulted in 17 completed screening surveys (i.e., $41 spent per completed survey), 5 eligible participants (i.e., $141 spent per eligible participant), and 2 enrolled participants. Effectively, we needed 137,666 impressions to generate a single participant at a cost of $352 per participant. By comparison, a total of $287 was spent on OkCupid banner ads, generating 143,515 impressions. This resulted in 11 clicks ($26 per click), 9 screening surveys started ($32 per survey), but no screening surveys were completed; thus, no participants were enrolled via OkCupid.

Next, we compared those sources that actually generated enrolled participants: Facebook and targeted electronic recruitment sources (i.e., emails to college professors and LISTSERVs). Participants recruited via targeted electronic sources were more likely to complete the survey after starting (63.9% vs. 34.0%), be eligible (45.1% vs. 29.4%), and (among those eligible) to enroll (99.1% vs. 40.0%) than were those recruited via Facebook. Targeted electronic recruitment was more cost-efficient than recruiting via Facebook ($1.59 was spent per enrolled participant versus $273.50 per enrolled recipient via Facebook). Examining cost by screening
surveys started, completed, and cost per eligible and enrolled participant was also more cost effective by targeted electronic source as compared to Facebook (see Table 4).

Finally, Table 5 illustrates the comparison of 3 banner ads (1 logo-only, 1 that included an image of a Black woman with the study logo, and 1 depicting a Latina woman with the study logo) using web analytics ($p < 0.001$). Further paired chi-square tests revealed a significant difference when comparing all 3 banner ads ($p < 0.001$), where the banner ad including the image of a Black woman yielded the highest click-through-rate. The images with women yielded a higher click-through rate (1.66% for the banner ad including an image of a Black woman and 1.37% for the banner ad including the image of a Latina woman, respectively) in comparison to the logo-only banner ad (CTR = 1.07%). The cost per link click was $0.24$ for the logo-only image, and $0.16$ and $0.17$ for the banners with images of the Black and Latina women, respectively. Thus, including images of women yielded a higher click-through-rate and was more cost effective.

**DISCUSSION**

This study compared efforts to recruit and enroll young Black and Latina women into a pilot RCT using online banner advertisements and targeted electronic outreach (i.e., emails to college professors and LISTSERVs). We additionally evaluated recruitment approaches using cost and analytics metrics. These included the amount of money spent (in terms of purchasing ads as well as person-hours excluding incentives) per enrolled participant. Targeted electronic recruitment was more cost efficient than recruiting via Facebook. Despite a large number of impressions and clicks via the Facebook banner ads to the study survey, they generated more ineligible participants ($n = 12$) than eligible ones ($n = 5$) and only generated 2 enrolled participants. Unfortunately, the other attempted electronic approaches (OkCupid banner ads and
a posting on Eventbrite) fared worse than Facebook and generated no completed screening surveys, and thus yielded no eligible or enrolled participants. Eventbrite was initially selected because we had successfully used this tool to recruit young women for formative focus groups, and may yet serve as a more useful tool to coordinate a focus group (i.e., sending out reminders, including details of where, when, how to get to venue, etc.) rather than as an effective recruitment approach for quantitative longitudinal research. Cross-sectional studies have been especially successful in recruiting participants online; whereas longitudinal studies have drawn their target sample size from a variety of recruitment approaches. Although online approaches were used to attract a sizeable sample in many cases, they were not the single source for recruits, especially for RCTs.

A review found that 32% of participants were recruited via social media (where the range was 0% [0/12] to 98.29% [1610/1638]), and, had this study been better funded to run the ads for a longer period, it might have generated a greater proportion of enrolled participants as a result. A possible explanation of why MSM are more successfully recruited via online mediums versus what we found here could be that there are considerably more research opportunities for MSM given HIV disparities than there are for women of color (or just about any other sub-population). Perhaps the large number of MSM-focused studies has contributed to allowing researchers to make adjustments needed to successfully recruit MSM. The larger number of opportunities might also be contributing to MSM expecting, understanding, and trusting research and, ultimately, being willing to participate in research in a way that YWOC are as they are not exposed to such opportunities.

Participants recruited via targeted electronic sources (i.e., email and LISTSERVs) were more likely to complete the baseline survey after starting, be eligible, and (among those eligible)
to enroll in the study than were those recruited via Facebook. We acknowledge that professors may have shared the email we sent with other students, professors, and staff and thus, may have increased the reach beyond that reported here. It seems that recruiting young women of color might be facilitated through known and trusted adults, such as professors, who are connected to these young women rather than through an anonymous banner ad on social media. Our findings may suggest that users do not want to engage with unknown entities without something or someone to validate the research for them. We recruited through professors and there is evidence suggesting that professors are a good recruitment source as students trust their professors.179–181

We acknowledge that this is a select sample of college students who were primarily recruited from CUNY institutions, which is known to have 84.1% of senior and community colleges originate from a NYC public or private high school.182 It is unknown whether online recruitment efforts supported off-line recruitment efforts, meaning, participants could have heard about the study on social media and not enrolled, but then may have been primed and ready to register when they heard about it through their professor or school.

Social networking websites and online dating websites have a broad reach with the target population, as evidenced by the 275,000 impressions and 1986 clicks on banner ads to the study screening survey, however, the low consent rate to agree to participate in a longitudinal survey could be reflective of those who accidentally clicked on the survey link or of individuals who were not interested in the study. Perhaps an online approach should be combined with other methods, such as individual participants who are asked or incentivized to recruit other participants (i.e., seeds) as with the JustUs study56 and with a recent San Francisco-based study of transwomen183. We initially set out to recruit using 2 practices that did not work. First, we wanted to recruit on Tinder, but they were not allowing banner ads at the time of the study
recruitment phase. Second, we attempted to recruit on Facebook by race/ethnicity only to learn that targeting ads in that way is not permitted. The actual image can state recruitment by race/ethnicity, but it is against the rules to filter who is shown a banner ad by race/ethnicity. This resulted in an approved Facebook ad running for 10 days before modifications were required. In retrospect, we agree that targeting banner ads by race/ethnicity is not allowed with good reason as this could be used to exclude people of color, so instead we used banner ads that included pictures of people of color.

**Banner ads**

Banner ads with images of women yielded a higher click-through rate (1.66% for the banner ad including an image of a Black woman and 1.37% for the banner ad including the image of a Latina woman, respectively) in comparison to the logo-only banner ad (CTR = 1.07%) and were statistically significant at the $p < 0.0001$ level. The banner ad including the image of a Black woman was the most effective in terms of click-through rates and cost-per-link ($0.24$ logo-only; $0.16$ for the banner ad including a Black woman, and $0.17$ for the banner including a Latina woman). Our findings aligned with other findings for social media and recruitment that came via professors, which accounted for the majority of recruitment for this study.\(^\text{167}\) Potential enrollees responded more positively to the banner ads with people and the logo, rather than only the use of the logo. Future researchers and health providers should consider banner ads that include both a study logo and images reflecting the population of interest, and avoid limiting themselves to only recruiting via banner ads on social networks and online dating websites. The conversion rate was good in comparison to other health research click-through rates,\(^\text{40,154,155,164}\) thus, a future approach might be to expand funding to recruit women via banner ads for a longer period.
Kelly and colleagues developed a model suggesting that advertising in the online social networking environment is more likely to be avoided if: the user has expectations of a negative experience, the advertising is not relevant to the user, the user is skeptical toward the advertising message, or the consumer is skeptical toward the advertising medium. College students specifically who were users of online social networks do not dislike advertisements, rather, they go unnoticed. Our findings align with this notion. The logo-only ad might have been perceived as less relevant than ads that included images that might represent potential participants by ethnicity and by gender. In addition, banner ads targeting MSM of color have been shown to increase the click-through rate.

**Enrolled versus did not enroll characteristics**

Those enrolled in the study were more likely to report an income below $20,000 and to be working or to be a student than were those who did not enroll. No participant reported an income above $50,000 either among those enrolled or among those who chose not to enroll in the study. We attribute these findings to a possible increased interest in a paid study among those with less income. We also acknowledge that age, education level, and income are linked. The majority of those who chose not to enroll in the study were also working full- or part-time or were students, perhaps a function of recruiting at local colleges. Interestingly, there was no difference in educational level when comparing the 2 eligible groups (enrolled versus choosing not to enroll).

**Limitations**

There were several limitations to this study. We intended to create different abbreviated links to be used for each recruitment method to be able to track traffic, which would have allowed us to run analysis by recruitment source that was not self-report data. There was a
technical glitch, however, and we had to rely on self-report data, which is susceptible to recall bias and high missing values. For example, a few participants indicated that they heard about the survey on Tinder, but this was not one of the places where we recruited participants. Using our best judgment, we recoded this data into an appropriate bin or as missing data. There were no recruits via OkCupid and this may be due to (or perhaps exacerbated by) the fact that OkCupid users can pay $7 a month not to receive banner ads. Thus, it is possible that our intended banner ad target audience was considerably reduced.

Of note, we did not include mean age of first sex and mean age of oldest male sex partner in the present analyses due to a very high rate of missing variables among those not enrolled, 43.5% and 47.8% respectively for these variables. These results should be interpreted with caution and the high rate of missing variables could be an indication of the sorts of sensitive questions participants were asked that generated discomfort. None of these comparisons were statistically significant. Those who did not enroll in the study reported an older mean age (M [SD] 27.1 [5.2]) of their oldest male sex partner than those who did enroll (M [SD] 25.9 [6.5]) and the mean age of first sex was between 16 and 17 years old for both groups, in alignment with national data (17.3 years of age).189

There were limited resources to carry out this dissertation research and a better-funded study might draw a larger enrolled sample from Facebook banner ads if more funds were available for more advertising. In the end, we recruited the majority of our sample within the CUNY system, which may impact our external validity. However, CUNY is a sub-population reflective of New York City with 83.7% of their total population reporting a high school background from within New York City.182

CONCLUSIONS
Although we expected to recruit our sample capitalizing off the broad reach that social networks and online dating websites had to offer (specifically, on Facebook and OkCupid), we found that recruiting a sample of young women of color in New York City (Black and Latina women) aged 18 to 25 was more easily achieved through CUNY professors and campus LISTSERVs. We do not recommend using Eventbrite as a recruitment approach for a longitudinal study, and further research is needed to understand how social media banner ads might be used as an effective recruitment source for this specific population. For example, social media banner ads may be more appropriate for short-term studies or one-time surveys, as trends in data have shown, and may yield better returns with a banner ad campaign running for more than 10 weeks. Despite the broad potential reach that Facebook and OkCupid banner ads have, our findings showed marked differences in the number of enrolled participants between targeted electronic outreach and online-based samples in our efforts to recruit a sample for a health tech pilot. Targeted electronic recruitment (i.e., emails and LISTSERVs) generated a greater proportion of young Black and Latina women aged 18 to 25 who participated in a sexual health web-based app pilot RCT. We did not find it feasible to recruit a large sample of women through banner ads on an online dating web-app and social network banner ads yielded somewhat more success. Moreover, snowballing recruitment through a gatekeeper and professors yielded the best results.
Figure 1. Banner Advertisement Images
Figure 2. Consort Diagram

Did not consent
\[ n = 9, 1.5\% \]

All recruited
\[ N = 583, 100\% \]

Dropped off
\[ n = 82, 14.1\% \]

Did not complete survey in full
\[ n = 243, 49.4\% \]

Consented to screen
\[ n = 492, 84.4\% \]

Screened ineligible for study
\[ n = 91, 18.5\% \]

Eligible and did not consent
\[ n = 16, 3.2\% \]

Eligible and provided consent
\[ n = 140, 28.5\% \]

Completed survey
\[ n = 122, 87.1\% \]

Did not complete survey
\[ n = 18, 12.9\% \]

Not reached to complete enrollment
\[ n = 8, 6.6\% \]

Completed enrollment
\[ n = 114, 93.4\% \]

Intervention
\[ n = 61, 53.5\% \]

Control
\[ n = 53, 46.5\% \]

Did not complete post-test
\[ n = 4, 0.07\% \]

Completed post-test
\[ n = 57, 93.4\% \]

Did not complete post-test
\[ n = 5, 0.09\% \]

Completed post-test
\[ n = 48, 90.6\% \]
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<th>Author, publication year</th>
<th>Population</th>
<th>Study design, N</th>
<th>Type of intervention</th>
<th>Intervention description</th>
<th>Results</th>
<th>Recruitment Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marhefka et al., 2014</td>
<td>18+-year-old women with HIV</td>
<td>RCT, N=71</td>
<td>Video-group using videophones</td>
<td>Healthy Relationships Video-Group: a video-group adaptation of the evidence-based Healthy Relationships which involved six 2-h sessions via videophones led by 2 facilitators located at a different site.</td>
<td>At 6-month follow-up, no significant difference between arms in engaging in any sex: no, unprotected, or protected sex. Among those who engaged in any unprotected sex in the previous 3 months, the intervention arm had 6.89 fewer unprotected sex acts than the control arm.</td>
<td>Recruitment flyers posted at clinics and other organizations serving women living with HIV in each catchment area.</td>
</tr>
<tr>
<td>Jones et al., 2013</td>
<td>18- to 29-year-old women</td>
<td>RCT, N=295</td>
<td>Videos streamed via smartphones</td>
<td>Love, sex, and choices: 12-week soap opera video series delivered to study-provided smartphones; 15–20-min episodes streamed weekly with plots that deal with characters in high-risk relationship dilemmas demonstrating the process of changing risk behaviors.</td>
<td>At 6 months post-intervention, video group had a significant decrease in condomless sex acts in past 3 months, from 21.33 at baseline to 5.92. However, no significant difference observed between the 2 study arms.</td>
<td>Recruited at 2 public housing developments, 2 STD clinics, a community center, a storefront office, and a food pantry, all located in 4 contiguous cities in predominantly African American neighborhoods.</td>
</tr>
</tbody>
</table>
Table 1. Summary of mHealth Articles Focused on Women of Color Continued

| Jones et al., 2015 | 18- to 29-year-old women | *Online pilot, N=40* | Videos streamed via smartphones | Guide Enhanced Love, Sex, and Choices (GELSC) | At 30-day follow-up, 18 participants (46.2%) had fewer sex partners than at baseline, 27 (69.2%) were not having unprotected sex with a high-risk partner, 29 (74%) felt that GELSC helped them to talk more openly with their partners about using condoms, 17 (43.6%) had had an HIV test during the previous 30 days. 27 (69.2%) had discussed HIV testing with their partners, and 12 (30.8%) reported that their partners had been tested. | Facebook ads launched for 30 days. |

Computer-based technology: *Exclusively computer-delivered interventions*

| Klein et al., 2011 | 14- to 18 year-old AA adolescent females | *RCT, N=178* | Computer-based | Multimedia SiHLE: Two 1-hour computer-based sessions adapted from an evidence-based intervention. Intervention consisted of videos that simulate small group discussions as well as interactive activities such as role-playing exercises, games, and quizzes. Control: 65-minute computer-delivered videos on diet and nutrition | Pre-post change in mean proportion of condom-protected vaginal intercourse acts increased from 51% at baseline to 71% 3 months post-intervention (*p* = 0.05) in intervention arm. No significant change was observed in control arm. No comparison of arms provided. | Contracted market research firm, Nichols Research, to lead recruitment efforts, which included: emails to likely participants from the firm’s database, Craigslist ads, Nichols’ Facebook and Twitter accounts, fliers at schools, and referrals from contacted individuals. |
Table 1. Summary of mHealth Articles Focused on Women of Color Continued

<table>
<thead>
<tr>
<th>Authors</th>
<th>Participant Description</th>
<th>Study Design</th>
<th>Technology Type</th>
<th>Intervention Details</th>
<th>Control Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Klein et al., 2013</td>
<td>18- to 50-year-old AA women with HIV</td>
<td>RCT, N=187</td>
<td>Computer-based</td>
<td>Multimedia WiLLow: a computer-delivered adaptation of an existing evidence-based intervention. Two 1-hour modules included visual and audio presentations, videos of group discussions from traditional WiLLow, and a tutorial for those with limited computer literacy.</td>
<td>Intervention arm reported higher proportion of condom-protected sex acts in past 30 days and were more likely to report consistent condom use and have lower number of unprotected sex acts in the past 30 days compared with the control arm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Face-to-face and handing out fliers executed by trained caseworkers and other health-care professionals working with HIV-positive African American women.</td>
<td></td>
</tr>
<tr>
<td>Card et al., 2011</td>
<td>18- to 29-year-old AA women</td>
<td>RCT, N=135</td>
<td>Computer-based and face-to-face</td>
<td>SAHARA: Two 1-hour computer-based sessions adapted from the evidence-based SISTA. Intervention comprised of video clips of group discussions and modeling of self-protective behaviors; interactive modules included simulated role-playing and games and quizzes. Computer sessions followed by a brief 20-minute group wrap-up</td>
<td>At 3 months post-intervention, intervention arm had greater HIV/STI prevention knowledge, condom self-efficacy, and a high percentage reported of condom-protected sex acts (85.3 vs. 52.8 %, <em>p</em> = 0.03), and more consistent condom use (aOR = 5.9, 95% CI = 1.09–31.95) compared with the control arm</td>
</tr>
<tr>
<td>Wingood et al., 2011</td>
<td></td>
<td></td>
<td></td>
<td>Conducted at Planned Parenthood, Atlanta, Georgia. Specific recruitment approaches or activities were not detailed.</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Participants</td>
<td>Design</td>
<td>Intervention Details</td>
<td>Findings</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------</td>
<td>--------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>El-Bassel et al., 2014</td>
<td>18+-year-old women with criminal justice system involvement</td>
<td>RCT, N=306</td>
<td>Computer-based and face-to-face Traditional WORTH: comprised of four 1.5- to 2-hour sessions focused on HIV prevention psychoeducation and skills building occurring once a week for 4 weeks led by a facilitator Multimedia WORTH: same schedule as the traditional version except content delivered in a group session via laptop computers with facilitator in a more limited role. Computer content included interactive computer games, video vignette, and a computerized and web-connected tool to identify needed services. Control: attention-control wellness promotion intervention delivered in group setting.</td>
<td>Over the 12-month follow-up period, both WORTH conditions were significantly more likely to have a higher proportion of condom-protected sex acts and consistent condom use as compared with control. No significant difference noted in HIV/STI incidence between the 2 WORTH conditions and control condition. Trained recruitment staff engaged participants. Specific recruitment approaches or activities were not detailed.</td>
<td></td>
</tr>
<tr>
<td>Brown et al., 2011</td>
<td>18+-year-old women with HIV</td>
<td>RCT, N=60</td>
<td>Computer-based Intervention: One 90-minute computer-delivered session adapted from an evidence-based stress management intervention for men who have sex with men. Modules included an overview of stress and associated symptoms, how to evaluate stressful situations, coping strategies, and relaxation training. Participants received a brief motivation session as well as a workbook and CD.</td>
<td>Stress management knowledge increased significantly in the intervention arm as compared with the control arm. However, no differences between arms were observed in other measures. Recruited through an outpatient infectious disease clinic in upstate New York.</td>
<td></td>
</tr>
</tbody>
</table>
Table 1. Summary of mHealth Articles Focused on Women of Color Continued

| Internet-based technology | Danielson et al., 2013 | 12- to 19-year-old females | Pre- post, N=41 | Website | Control: wait-list control SiHLEWeb.com: Four 1-hour modules using video-based design to simulate group discussion and enable interactive activities with real-time feedback. Also included are video peers, health educations, and a near peer. | 63% of sample completed website. Among completers, significant improvements were noted in condom use-self-efficacy at 3 months post-intervention. No changes were observed in partner communication, ethnic pride, and self-esteem. | Recruits from a large Southeastern city in collaboration with community partners (local high schools, Department of Juvenile Justice, child advocacy center, medical university) through use of fliers, postings, word-of-mouth, and bulletin advertisements including paper fliers that were distributed among community-based organizations serving the target population and other places in the local community where the target population spent their time (e.g., Walmart). |

### Table 2. Facebook and OkCupid Selection Criteria

<table>
<thead>
<tr>
<th>Facebook selection criteria</th>
<th>OkCupid selection criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Gender: Female</td>
<td>o Gender: Females</td>
</tr>
</tbody>
</table>
| o Location (Living In): United States: Bronx (+25 mi), Brooklyn (+25 mi), New York (+25 mi), Queens (+25 mi), Staten Island (+25 mi) New York | o Geography: NY, NY, and select NJ cities that are easily accessible to NYC via PATH Trains  
  ▪ Hoboken  
  ▪ Union City  
  ▪ Jersey City  
  ▪ Newark                                                                                                                                                       |
| o Relationship Status: Single, Unspecified, Open Relationship, Complicated or Separated     |                                                                                                                                                                                                                            |
| o Interested in: Men, or Men and Women                                                     |                                                                                                                                                                                                                            |
| o Age: 18–25                                                                                |                                                                                                                                                                                                                            |
| o Language: English (UK) or English (US)                                                    |                                                                                                                                                                                                                            |
Table 3. Demographic Characteristics and Health Risk Behaviors, Past 3 Months

<table>
<thead>
<tr>
<th>Race/ethnicity</th>
<th>Enrollment Status</th>
<th>Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latinas (including Black-Latinas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or Partnered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married or partner</td>
<td>66</td>
<td>29</td>
</tr>
<tr>
<td>Missing*</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>Single</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing*</td>
<td>42</td>
<td>12</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school, high school, GED, some college</td>
<td>68</td>
<td>23</td>
</tr>
<tr>
<td>College degree or master’s degree completed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing*</td>
<td>57</td>
<td>19</td>
</tr>
<tr>
<td>Currently enrolled in college</td>
<td>53</td>
<td>16</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing*</td>
<td>96</td>
<td>27</td>
</tr>
<tr>
<td>Income</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Up to $19,999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing*</td>
<td>86</td>
<td>17</td>
</tr>
<tr>
<td>Employed</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td>Working full or part-time or student</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not paid work (looking for work, unemployed, caretaker)</td>
<td>99</td>
<td>27</td>
</tr>
<tr>
<td>Missing*</td>
<td>99</td>
<td>27</td>
</tr>
<tr>
<td>Condomless sex in lifetime</td>
<td>11</td>
<td>8</td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Missing*</td>
<td>97</td>
<td>24</td>
</tr>
</tbody>
</table>

Table 3. Demographic Characteristics & Health Risk Behaviors, Past 3 Months Continued

<table>
<thead>
<tr>
<th>Enrollment Status</th>
<th>n</th>
<th>%</th>
<th>Not Enrolled</th>
<th>n</th>
<th>%</th>
<th>Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enrolled</td>
<td>N = 110</td>
<td></td>
<td>Not Enrolled</td>
<td>N = 46**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Income</td>
<td>-</td>
<td>11</td>
<td>11</td>
<td>2</td>
<td>4.4%</td>
<td>$\chi^2 = 0.36 (1)$</td>
</tr>
<tr>
<td>Currently enrolled in college</td>
<td>-</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>-</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Number of male sex partners

<table>
<thead>
<tr>
<th></th>
<th>Enrolled</th>
<th>Not Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M (SD) or %</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>110</td>
<td>22.1 (2.1)</td>
</tr>
<tr>
<td>Mean age of first sex (SD)</td>
<td>110</td>
<td>17.1 (2.7)</td>
</tr>
<tr>
<td>Mean age of oldest male sex partner (SD)</td>
<td>110</td>
<td>25.9 (6.5)</td>
</tr>
<tr>
<td>15 years old or younger</td>
<td>58</td>
<td>52.7%</td>
</tr>
<tr>
<td>16 to 18 years old</td>
<td>29</td>
<td>26.4%</td>
</tr>
<tr>
<td>19 to 21 years old</td>
<td>14</td>
<td>12.70%</td>
</tr>
<tr>
<td>22 to 23 years old</td>
<td>8</td>
<td>7.30%</td>
</tr>
<tr>
<td>50 years old</td>
<td>1</td>
<td>0.91%</td>
</tr>
<tr>
<td>Missing</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 1.45 (1) \quad p = 0.23 \]

*Missing values were excluded from significance testing.*

** This number varies due to missing values.
Table 4. Analytics, Cost, Enrollment Data by Recruitment Source

<table>
<thead>
<tr>
<th>Targeted electronic (Professor)</th>
<th>Facebook</th>
<th>OkCupid</th>
<th>Totals</th>
<th>Fisher’s exact or $\chi^2$ (df)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web-analytics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impressions on banner ads</td>
<td>NA</td>
<td>275,332</td>
<td>143,515</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total clicks</td>
<td>NA</td>
<td>1986</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Click-through-rate (clicks/imp)</td>
<td>NA</td>
<td>0.72%</td>
<td>0.00%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening Surveys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening surveys started</td>
<td>385</td>
<td>50</td>
<td>9</td>
<td>446</td>
<td></td>
</tr>
<tr>
<td>Screening surveys completed</td>
<td>246</td>
<td>17</td>
<td>0</td>
<td>263</td>
<td></td>
</tr>
<tr>
<td>Surveys completed/surveys started</td>
<td>63.9%</td>
<td>34.0%</td>
<td>0</td>
<td>0.58968</td>
<td>6099</td>
</tr>
<tr>
<td>Eligible Participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ineligible</td>
<td>65</td>
<td>12</td>
<td>0</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>Eligible</td>
<td>111</td>
<td>5</td>
<td>0</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td># eligible/# completed</td>
<td>45.1%</td>
<td>29.4%</td>
<td>0</td>
<td>0.44106</td>
<td>4639</td>
</tr>
<tr>
<td>Enrolled Participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrolled</td>
<td>110</td>
<td>2</td>
<td>0</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>Not enrolled</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td># enrolled/# eligible</td>
<td>99.1%</td>
<td>40.0%</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total $ spent on recruitment</td>
<td>$175.00</td>
<td>$704.75</td>
<td>$287.02</td>
<td>$879.75</td>
<td></td>
</tr>
<tr>
<td>Amount $ spent per impression</td>
<td>—</td>
<td>$0.00</td>
<td>$0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount $ spent per click</td>
<td>—</td>
<td>$0.35</td>
<td>$26.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$\chi^2 = 16.55 (1)**, $p < 0.0001

$\chi^2 = 7.32 (1)**, $p = 0.0068

Fisher’s exact**, $p < 0.0001
Table 4. Analytics, Cost, Enrollment Data by Recruitment Source Continued

<table>
<thead>
<tr>
<th>Amount $ spent per</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>started screened participant</td>
<td>$0.45</td>
<td>$14.10</td>
<td>$31.89</td>
<td>$1.97</td>
</tr>
<tr>
<td>completed screened participant</td>
<td>$0.71</td>
<td>$41.46</td>
<td>0</td>
<td>$3.35</td>
</tr>
<tr>
<td>eligible participant</td>
<td>$1.58</td>
<td>$140.95</td>
<td>0</td>
<td>$7.58</td>
</tr>
<tr>
<td>enrolled participant</td>
<td>$1.59</td>
<td>$352.38</td>
<td>0</td>
<td>$7.85</td>
</tr>
</tbody>
</table>

*130 participants did not indicate their recruitment source and were excluded from analysis; thus, why totals do not add up to final recruitment number

— no statistical test calculated.

** Test statistic on Facebook and targeted electronic only.
Table 5. Banner Analytics on Facebook Ads

<table>
<thead>
<tr>
<th></th>
<th>GURHL Code Logo Only</th>
<th>Banner ad including image of a Black woman</th>
<th>Banner ad including image of a Latina woman</th>
<th>$\chi^2$ (df)</th>
<th>$p$ value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount Spent</td>
<td>$172.75</td>
<td>$310.10</td>
<td>$221.90</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Impressions</td>
<td>66,500</td>
<td>115,821</td>
<td>93,011</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Clicks</td>
<td>714</td>
<td>1925</td>
<td>1278</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Cost-per-link-click</td>
<td>$0.24</td>
<td>$0.16</td>
<td>$0.17</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Click-through-rate (clicks/impressions)</td>
<td>1.07%</td>
<td>1.66%</td>
<td>1.37%</td>
<td>$\chi^2=106.64 (2)$</td>
<td>$p = &lt; 0.0001$</td>
</tr>
</tbody>
</table>


CHAPTER 3—Assessing Feasibility and Acceptability of Guide to Understanding Reproductive Health for Ladeez (GURHL) Code, A Sexual Health Responsive Web-Based App Intervention for A Pilot Randomized Controlled Trial

Target Audience: Public health audience (Sexual reproductive health and STD/HIV researchers)

ABSTRACT

Black and Latina women continue to suffer from higher HIV diagnosis than White women. Mobile phones are a known and established communication and information-seeking tool utilized by young people of color. This pilot randomized controlled trial explored the feasibility and acceptability of a web-app–delivered SRH intervention called Guide to Understanding Reproductive Health for Ladeez (GURHL) Code. The intervention was a web-based application that included: a clinic locator and list of trusted sexual health resources; a list of things to prepare and bring to a clinic visit; text access to a National Planned Parenthood health educator; 2 audio stories of how a man and a woman contracted HIV as young adults and are living with HIV in NYC; clear and medically accurate information on STDs, sexuality, and sexual health; visual representations and instructions on how to properly put on a male and female condom and where to find free condoms in NYC; and a basic educational video on reproductive anatomy. The intervention was compared to a web-based control site that included a “flier on the web” listing clinics and online sexual health resources. The study recruited self-identified Black or Latina women aged 18 to 25 who owned a smartphone, were living or working in New York City, and reported vaginal or anal intercourse with a male partner in their lifetime. Triangulating focus groups, survey responses, and web analytics results suggest participants were enthusiastic about several aspects of the intervention GURHL Code web-app in comparison to the standard-of-care control web-app. These aspects included the clarity in
language, the transparency of the developer and designer, access to the Planned Parenthood text function, and Questions, Honest Answers. Participants from both treatment conditions found both web-apps easy to use and well organized, and additionally found the GURHL Code intervention web-app to be trustworthy and useful.

**BACKGROUND**

Although new HIV diagnoses among women and young people have decreased in the United States between 2005 and 2014, racial and ethnic disparities continue to impact Black and Latina women and younger age groups. In 2014, Black women accounted for 6 in 10 diagnoses among women and although Latinos made up 17% of the US population, they accounted for 23% of newly diagnosed HIV infections. In addition, despite decreases in diagnoses, declines have stalled between 2009 and 2014 for Latinos, and in 2015, 80% of the 8807 young people diagnosed with HIV in the United States were aged 20 to 24. As public health practitioners, researchers, and policy makers seek to continue to decrease HIV incidence among and to reach young women of color, the use of a tailored smartphone web-based application may offer innovative techniques and approaches to prevent HIV, and other STDs.

The rapid adoption rate of smartphones among Latinos and Blacks provides opportunities to utilize these technologies for HIV and STD prevention. In 2015, 70% of Black adults and 71% of Latino adults compared to 61% of White adults owned a smartphone; 67% Blacks and 73% of Latinos versus 58% of Whites used their smartphones to seek information about a health condition. In addition, analyses of the 2011–2014 Health Information National Trends Survey (HINTS) estimated that 1 in 3 US adults use the Internet to diagnose or learn about a health concern. Mobile devices allow users to interact with web-based applications that offer portability, and autonomy (web-apps allow access at users’ desired location and time); tailored
content (with target population’s input); cost-effectiveness and content standardization (technology reduces need for health promotion or clinical staff-related costs); and includes interactive delivery of health information. Web-apps additionally offer the benefit of reaching the greatest number of smartphone users regardless of operating system (Apple, Android, or Windows). This is relevant for a younger population who are known to use a combination of flip phones and older devices such as the Apple iPod touch (an iOS-based handheld that only connects to the Internet through Wi-Fi and not cellular) with a touchscreen to access the Internet and web-apps.

The World Health Organization (WHO) defines mobile health, also known as mHealth, as, “the use of mobile and wireless technologies to support the achievement of health objectives.” These digital tools provide the possibility of delivering health information, professional consultation, and health provider and services cost and location information to individuals in a way that is more timely and private, and therefore more useful, than traditional health education and service delivery models that require individuals to physically travel to a clinic or school for such services.

Findings from sexual mHealth research suggest that mHealth may offer inroads for reaching young adults to promote positive sexual and reproductive health behaviors, however, this literature is nascent. One systematic review found sexual and reproductive health (SRH) web-apps suffered from unfavorable reviews, which limit uptake, use, and dissemination. Moreover, research specifically on young adults’ experiences and views on a range of web-app features is lacking, particularly with regards to those being developed for Black and Latina women.
Despite a growing body of literature on the formative development of smartphone applications,\textsuperscript{65,89–94} there are limited feasibility sexual and reproductive mHealth studies.\textsuperscript{95} Two such studies of smartphone apps were 1) to promote pregnancy and interconception health (the health of women from one pregnancy to the next) among Black women\textsuperscript{83} and 2) HealthMindr, a web-based application designed for men who have sex with men (MSM) to prevent HIV.\textsuperscript{98,205,206} A strength of both was the community participatory approach implemented in developing the mHealth tools. Both conducted focus groups and engaged professional health care workers to learn preferences for content of each web-app.\textsuperscript{83,206} However, the mHealth tool for women was designed to receive and respond to text messages according to their reproductive stage profile; participants did so on a flip-phone provided at the beginning of the 6-month study. As all participants enrolled in the study had smartphones, women wanted messages to be delivered on their phones. This research highlights how the research cycle is sometimes unable to keep apace with changes in technology made available to the public.\textsuperscript{57,142}

The HealthMindr Android application for HIV prevention had more promising results. It included self-assessment tools; prevention recommendations; commodity (condoms, HIV self-tests) ordering; reminders to MSM for basic HIV prevention services, HIV testing, condom use, screening for pre-exposure prophylaxis (PrEP) and non-occupational post-exposure prophylaxis (nPEP); and prevention and treatment provider locators.\textsuperscript{98} The commodity-ordering features of the web-app were used by most men during the 4-month study: nearly two-thirds of men ordered condoms and over half ordered an at-home HIV test kit at least once, usually on their first visit to the web-app. Many men placed multiple orders of condoms and HIV test kits, suggesting that this feature offered users a reason to return to HealthMindr. Eight of 86 (9%) PrEP-eligible MSM started PrEP during the 4-month period; of those, 6 of the 8 reported that the web-app
influenced their decision to start PrEP. Sullivan and colleagues’ 2017 study results are promising and warrant a larger scale RCT.

Although the web-apps described above targeted at-risk populations for sexual and reproductive health, neither of these mHealth pilots focused on sexual and reproductive health in Black and Latina women aged 18 to 25 residing in an urban area. The pregnancy and interconception health pilot was designed for use by pregnant women aged 18 to 44 and HealthMindr was designed for MSM in Atlanta, Georgia and Seattle, Washington. A tailored web-based sexual health app informed by the needs and experiences of this target population may prove to be a valuable tool for engaging this population, and, subsequently, for improving sexual health knowledge and for connecting participants to clinical services. This study explored the feasibility and acceptability of a sexual and reproductive health web-based application, Guide to Understanding Reproductive Health for Ladeez (GURHL) Code, by drawing from 3 sources of data: survey questionnaire, web-analytics, and focus groups conducted after participants completed their 3 months post-test assessment.

METHODS

Overview

Data for this study were taken from Guide to Understanding Reproductive Health for Ladeez (GURHL) Code, a randomized 2-group pilot study (Intervention and Control, described below) to test the feasibility and preliminary efficacy of an online smartphone application designed for Black and Latina women aged 18 to 25 in New York City. The intervention consisted of a web-based application, or a website, that was designed with a mobile user in mind, to promote connection to clinical services and to improve sexual health knowledge. The control consisted of another website, also designed with a mobile user in mind, but without active
hyperlinks; it contained a listing of clinic information and a list of trusted sexual and reproductive health web resources, but was essentially a single page that users could scroll down. To help ensure cultural relevance, a community advisory committee was consulted to finalize the look, feel, and content of each form of recruitment (banner ads, recruitment emails, fliers). The web-app development process and details about the community advisory committee are described in Chapter 1. As opposed to formal usability testing, focus groups were selected to be triangulated with baseline survey, a 3-month follow-up survey, and analytics data due to the stage of maturity of the pilot project as a precursor to refine mHealth design. In addition, we conducted focus groups in an effort to explore issues indiscernible through the baseline, 3-month follow-up surveys, and analytics results. Measures on demographics, health risk behaviors, understanding other web-based applications, linkages to sexual and reproductive health services and knowledge were measured at baseline and at 3-months follow-up. The study also sought to better understand barriers to recruitment, enrollment, and retention to inform future studies. As a pilot study, it was designed to detect statistical changes around sexual health knowledge by treatment arm but not in behavioral outcomes.

Participants

To be eligible, participants had to self-identify as a woman between 18 and 25 years of age, and as Black and/or Latina; own a smartphone (i.e., a phone capable of accessing the Internet); live or work in NYC; and have reported vaginal or anal intercourse with a male partner in their lifetime. Pregnant women and mothers of children aged 2 or younger were ineligible to participate in the study because these experiences may have made them more likely to seek or use sexual or reproductive health services. Additional exclusion criteria included only being sexually active with women (ever), or being unable to read English.
Recruitment and procedures

Women were recruited via paid online banner ads (on a social network website, online dating website), and emails that included an attachment of a recruitment flier similar to what was displayed on the banner ads to youth-serving community-based organizations and to professors at local colleges, including fourteen 4-year schools, 4 community colleges, as well as campus clubs and organizations (i.e., STEM groups, volunteer focused groups, and student government) to be passed on to potential subjects either electronically or as a physical flier. Each source was chosen on the advice of the advisory committee. Recruitment fliers and banner ads included the study logo, described the study (i.e., using a sexual health app on a smartphone for 3 months, baseline and post-tests, optional follow-up focus group), advertised remuneration up to $70 for participating in all research components, and directed participants to the online eligibility screening survey (sample images and other recruitment details are detailed in Chapter 2). To enroll in the pilot randomized controlled trial (RCT), participants first completed the online eligibility screener, followed by the baseline survey, and then submitted a screenshot of the web-app saved as a bookmark on their phone to the study email address or study phone number. Research staff followed up via text or phone with those who had trouble completing this step.

After completing an online screener survey, providing consent, and completing a baseline assessment, a pre-generated random number assignment process available in the online survey program Qualtrics randomly and evenly distributed participants into each study arm. Chain randomization was utilized to reduce the likelihood of contamination. That is, a question was asked during the screening survey regarding their recruitment source, and when participants self-reported that they were referred from a friend or from the same professor, they were assigned to the same study arm. This was decided by the initial randomized participant from that group as
assigned by Qualtrics. A similar process was employed for professors: the first person to report a professor referred them to the study was then randomly assigned to either condition, subsequent students identified from that classroom were all assigned to the same arm. Participants were asked to complete a post-test after 3 months. All procedures and recruitment materials were reviewed and approved by the City University of New York Institutional Review Board (protocol # 381039).

**Description of intervention condition**

The GURHL Code web-app content was informed by 15 years of public health practice, community advisory committee (CAC) feedback, and formative focus group feedback. Content was also provided via an API that returns results as JSON given some parameters by Bedsider, a program of The National Campaign to Prevent Teen and Unplanned Pregnancy, for the web-app to connect to users clinics by providing the clinic name, a brief description of ages and specific populations served, hyperlinked telephone number, clinic website, link to allow the user to find on Google Maps, and the physical address. All hyperlinks were active so that users could click a button and then have links opened in another app on their phone (e.g., the telephone link would generate a pop-up prompt asking if the user wanted to use an app already installed on their phone or computer to dial that number; similarly, upon clicking the geo-location link to be opened in Google Maps automatically opened the link in Google Maps). Ibis Reproductive Health, an international clinical and social science SRH research nonprofit organization, gave permission to use their “Answering Difficult Questions: A Guide to Address Young Women’s Sexual Health Concerns,” a resource intended for assisting health care personnel to respond to young women’s concerns around sexuality and sexual health. National Planned Parenthood of America provided code to link participants to their web-based feature to chat with a national health
educator. The web-app was coded using HTML, CSS, PHP, and Javascript on a WordPress mobile-friendly website. Content was then refined after pretesting the web-app with a national sexuality trainer and a local physician for adolescents (see Figure 1). The intervention arm received this web-app as an interactive sexual and reproductive health (SRH) responsive web page that functioned as an app on an iPhone or Android smartphone after participants saved the website to their smartphones’ home screen. Content areas are described in Table 1.

**Description of control condition**

The control condition was also a web-app developed in HTML and CSS on a WordPress mobile-friendly website and, similar to the intervention web-app, functioned as an app on an iPhone or Android smartphone after it was bookmarked to the home screen. However, the content of the control website was a “flier on the web” and served as the standard of care (see Figure 2). It contained information that had been prepared and disseminated at health fairs in New York City. It listed clinics’ telephone numbers, physical addresses (with cross streets), websites, if available, by borough, and had a long-page website design. The control website also included a list of trusted websites, and a form to contact clinics was provided at the bottom of the page. With the exception of the “send” button on the contact form, no information on the static page had live hyperlinks. The RCT study design generated an inherent difference between the intervention and control groups: the control group participants saw and interacted with the full version of GURHL Code for the first time during the follow-up focus groups.

**Measures**

The primary study outcome was the intervention feasibility and acceptability assessed by feasibility and acceptability process measures, web analytics, and optional focus groups conducted after the 3-month post-test survey was completed. These are detailed below.
Demographics

Prior to randomization, participants completed a 15- to 20-minute online survey encompassing the eligibility screener followed immediately by the baseline survey programmed in Qualtrics. Participants were asked their age (in years), race/ethnicity (Black or Latina), relationship status (married or partnered for more than 1 year [yes/no]), education level (up to 6th grade, middle to high school, high school diploma, some college, college degree, some post-graduate work, master’s degree, or doctoral degree), college enrollment status (yes/no), employment (full-time, part-time, individual income, student, looking for work, or caregiver), and health insurance status (not insured, private insurance, or public insurance). At post-test, participants were asked to complete a survey identical to the baseline survey, and were additionally asked about their relative socioeconomic position by asking them to think of a ladder representing where people stand financially and educationally (social status) in the United States. At the top of the ladder are the people who have the most money and education, and the most respected jobs. At the bottom of the ladder are the people who have the least money and education, and the least respected jobs or no job. Participants were asked where they would place their family on this ladder (scale from 1 to 10). Participants were additionally asked if they were US-born (yes/no), if their parents were US-born (both parents US-born, 1 parent US-born, neither parent US-born, or don’t know), and whether their parents attended college (both, one, or neither parent went to college).

Health risk behaviors

At baseline and at 3 month’s post-baseline follow-up, participants indicated their age at first sex (in years), last sex act (oral, vaginal, anal), condomless sex acts during their lifetime (yes/no) defined as vaginal or anal sex without a condom, or during which a condom had broken,
or during which a condom had slipped off, and the number of sex partners during their lifetime (categories ranging from 1 to 26 or more partners).214 Participants were also asked at baseline and at 3-month follow-up the number of standard alcoholic drinks (definition and an image were included to clarify meaning) on a typical day (1 or 2, 3 or 4, up to 10, or more), whether they were buzzed or drunk during their most recent sexual encounter (yes/no), and any drug use (alcohol, cocaine, crystal meth, ecstasy, GHB/GBL, marijuana, Ketamine, heroin/opiates, crack, poppers, acid, or prescription drugs without a prescription) during the 30 days before or during their last sexual encounter (yes/no) using a validated instrument.215–218

Understanding other web-apps

To compare the study arms’ understanding of web-apps other than those used for the study, participants were asked at baseline and at the 3-month post-baseline survey to indicate if they used web-apps to search for information related to any of the following: their period; sexual anatomy; STD signs or symptoms they, a friend, or family member may be experiencing; pregnancy signs or symptoms they may be experiencing; or help finding a doctor. They were additionally asked whether they had problems understanding health information on web-apps (always, usually, about half the time, rarely, or never), and if health information found on web-apps was helpful to them (very helpful, somewhat helpful, neutral, somewhat unhelpful, very helpful).

Intervention feasibility and acceptability

At 3 months post-baseline, a series of items were included from the system usability scale (SUS).219,220 Participants were asked about the ease of installation of the web-app on their phone (very, somewhat, not easy), ease of using the web-app (yes, unsure, no), if they found the web-app complicated (yes, unsure, no), whether they found the various functions in this web-app to
be well organized (agree, unsure, disagree), whether they would keep the app on their phone after the study (yes, no, already deleted, unsure), and whether they would share the app with a friend or family member (already shared, will share in future, will not share, unsure).

Web analytics

Google Analytics is a free service that tracks and reports website traffic, providing aggregate measures of numbers of website visits, average time spent on a page per visit, etc. Google Analytics Javascript code was embedded in the back end of the intervention and control web-apps. We report several measures of user interaction with the control and intervention web-apps during the study period from October 7, 2015 to April 14, 2016, which could be compared across treatment arms. The following definitions were used:

- Sessions are the number of times visitors are actively engaged on a website.
- Number of unique users are the number of visitors who have had a minimum of one session within the selected date range; actions are tracked by an anonymously generated identifier from website cookies.
- Pageviews (per page) measures how many times someone has viewed an entire page including all content (i.e., text, images, etc.). This measure is a count of the number of webpages loaded.
- Pages per session is the average number of distinct pages viewed during a session. Multiple views of the same page in a session are counted as separate pages per session. Put another way, it is the number of repeated views of a single page during a session.
- Average session duration is the average time period in minutes a single user is interacting with the web-app in a single session, or visit. The time period is measured from the first hit until the last hit is made. A hit is a user’s interaction with a website that generates data
being sent to the Google Analytics server, for example, a pageview, a monetary
transaction, or clicking a social media button each constitutes a hit. By default, a session
lasts from the first hit until there is 30 minutes of inactivity.

- Bounce Rate is the percentage of single-page visits (i.e., visits in which the person left
either web-app from the entrance page without interacting with the page).
- Pathway measures the order of the pages that users clicked on and reports the pages with
the greatest number of sessions. Whereas sessions answer the question whether users
interacted with a website or web-app at all, pathway data allows one to explore more
specific behavior on a website.

From these web analytics, we reported the bounce rate, the number of sessions viewed and the
session duration, behavior flow, and proportion of returning users.

**Focus groups**

Four semi-structured focus groups, 2 within each study arm, were conducted after
preliminary analysis of baseline and post-test data to explore differences indiscernible from the
surveys and analytics measures. Focus group results were triangulated with baseline, post-survey
data, and analytics results. The focus group participants first shared which apps on their phones
they used most frequently and why they liked those apps in particular. The survey guide then
addressed the following domains with each group: reactions to the design of the web-app,
circumstances for usage and sharing the web-app, and attitudes toward app usage. Reactions to
the web-app allowed participants to explore what they remembered and what stood out about the
web-app assigned to them, if anything; circumstances for usage explored where and in what
situations the web-app might have been utilized (at school, at work, in crisis, for information
sharing), and with whom they were sharing their assigned web-app including which networks
(in-school peers, out-of-school peers, family, friends). To assess attitudes toward the web-app, participants were asked in focus group discussions if they would use the app again, whether they found it helpful for specific SRH tasks (e.g., scheduling a SRH-related appointment, learning about anatomy, etc.), barriers to using the app, and their perspectives on the app’s usefulness, trustworthiness, and ease of use. Feasibility of implementing GURHL Code in a future study was explored by asking questions around how easy or difficult it was to read the material from their smartphone screen, whether and how they liked the font, colors, and general web-app design.

Analytic plan

Sample characteristics

Using t-tests, chi-square, or Fisher’s exact tests, as appropriate, descriptive statistics were calculated to summarize sociodemographic, sexual risk behaviors, and understanding of web-apps other than those used for the study to compare young women in the 2 conditions.

Intervention feasibility and acceptability

To analyze the feasibility and acceptability data, we conducted chi-square and Fisher’s exact tests, as appropriate, between treatment and control groups to determine differences. To analyze the analytics data, we ran t-tests between treatment and control groups to determine differences regarding the number of times each web-app was opened, the amount of time spent, how often the web-app was used, the average length of time per session, and the average length of time per page or screen. All statistical analyses were performed using SAS 9.4 software.140 Of note, the control website had 66 countries represented and the top 5 countries were: 1) United States (n sessions = 734); 2) Russia (n sessions = 79); 3) China (n sessions = 47); 4) Japan (n sessions = 37); and 5) United Kingdom (n sessions = 31). In comparison, the intervention website also had visitors from 66 countries: 1) United States (n sessions = 784); 2) Russia (n
sessions = 69); 3) China (n sessions = 66); 4) United Kingdom (n sessions = 37); 5) Japan (n sessions = 30). Thus, we only examined analytics data generated from female users located in NYC.

Qualitative Data

During each focus group, a note taker captured observer notes. We conducted focus groups by study arm, thus we report thematic findings by intervention and control group. The intervention group includes users who had the intervention web-app for at least 3 months prior to participating in the focus groups. Control group participants first discussed the “flier on the web” and then they saw and interacted with the full intervention version on their phones and reacted to that experience. All focus groups were audio recorded, listened to iteratively, then the PI time-stamped and transcribed the focus group audio.

The PI and a research assistant (RA) then each coded the data independently using a systematic content analysis approach, in which key ideas, words, and phrases were grouped based on their relation to the purpose of the study to identify themes that accurately captured the data. Based on this systematic analysis with a priori domains, several differences between the intervention and control groups were interpreted. A consensus coding approach was used to generate the final codes for the dataset. We then applied the agreed upon coding scheme to the remaining coding process iteratively and further discussed any remaining questionable points in an effort to produce a meaningful account through a systematic process. The goal was to generate themes that accurately captured participants’ desired and intended use of a SRH web-app to inform augmentation of the GURHL Code.

RESULTS
Sample characteristics and retention

Figure 3 contains a CONSORT flowchart illustrating recruitment and retention proportions by study arm. In total, 114 Black and Latina women aged 18 to 25 years in New York City were enrolled and 105 women completed the intervention, a 92% retention rate. Of the 61 participants allocated to the intervention arm, 57 (93.4%) compared to 48 (90.6%) in the control arm completed the 3-month follow-up assessment. The study period was from October 7, 2015 to April 14, 2016 and 4 optional focus groups were conducted between April 18, 2016 and May 15, 2016 (intervention group, n = 6, control group, n = 7). Of note, only 2 participants were excluded because they did not own a smartphone, suggesting it is feasible to conduct a smartphone study for this target population.

There were no statistical differences between study arms on participant demographic characteristics and understanding of other web-based applications items indicating a successful randomization process (Table 2, understandability of other health web-based applications findings are detailed in Chapter 4). Of note, there was the potential for contamination if an enrolled student participant did not report the name of the professor who directed them to the study as participants were assigned to the treatment groups based on the initial person who identified the referring professor. If a student did not say they learned about the study from their specific professor and subsequently was assigned to a different group than everyone else in the classroom and then students shared web-apps with one another, then contamination was introduced to the study. The mean age for the total sample was 22.1 years (SD 2.1). Overall, the sample included more Latinas (60%) than Black women (40%), all had completed high-school, and 85.7% were enrolled in college, and 68.6% had neither parent born in the United States, but 73.3% of participants were US-born, and all but 3.8% had medical insurance (63.8% had private
and 32.4% had public insurance). Eighty percent of the sample were students \( (n = 84) \), 67.7% were employed \( (n = 71) \). Notably, 41.9% indicated they were students working part-time. With respect to sexual history, the mean age of first sex was 17.1 years (SD 2.8). Nearly 90% of participants reported condomless vaginal sex at least once during their lifetime. During the last reported sex act, 99.1% had engaged in vaginal sex, 69.5% in oral sex, 16.2% used sex toys, and 12.4% reported having anal sex. Thirty-eight percent reported 1 to 2 sex partners, 25.7% reported 3 to 5 sex partners, 36.2% reported 6 or more partners during their lifetime (Table 2).

**Intervention feasibility and acceptability**

Table 3 shows participants’ impressions of using the control and intervention websites and demonstrates that both arms were feasible and acceptable to participants. One item showed a trend toward significance in which a greater proportion of those in the intervention arm \( (93.0\%) \) thought the web-app was easier to use compared to the women in the control arm \( (83.3\%) \) (Fisher’s exact \( p = 0.07 \)). Other usability items were not significantly different by study arm, thus, we report results for the entire sample: 79% of the total sample reported they found the web-app they received easy to install on their phone, 79% found web-app functions and features to be well organized, 64.8% would keep the app on their phone. Among the total sample, 69.2% reported they would share it with a family member, and 69.2% reported they believed they would share the web-app with a friend after the study was completed. Of note, among the total sample, 68 \( (64.8\%) \) planned on sharing the web-app in the future with a family member, 72 \( (69.2\%) \) said they planned to share the web-app with a friend in the future. There were no significant differences in whether participants found the web-app they used during the 3-month study period to be complicated to use \( (91.4\% \text{ overall reported they did not find it difficult to use}) \).
Table 4, demonstrating web analytics results, shows a significantly lower bounce rate (visits in which the person left either web-app from the entrance page without further interaction) during the study period for the intervention web-app versus the control web-app. However there were no statistical differences regarding session duration: On average those on the intervention web-app viewed 1.82 pages per session and spent an average of 53 seconds during each session in comparison to those who had the single page “flier on the web” who spent an average of 30 seconds on the website per session. Web analytics behavior flow data showed that the pages of the intervention web-app most frequently visited were Questions: Honest Answers (103 page views), It Happened to Me (60 page views), Text an Expert (54 page views), My Parts (53 page views) and Things for the Clinic Visit (48 page views). There were 88 users of the control web-app who logged 1 or 2 sessions compared to 68 such users of the intervention web-app. There were 16 intervention users who logged 7 or more sessions compared to 12 control web-app users who logged 7 or more sessions. There were 45.4% \((n = 356)\) sessions by returning users on the intervention website compared to 31.5% of returning users on the control website.

**Focus group results: thematic findings**

Table 5 reports focus group findings from the intervention and control groups. The themes reported on were: motivations to use, benefits, sharing the web-app, barriers to usage, and participant structural factors. The findings reported are on reaction to the overall design, and on recommendations. When the focus groups were conducted, participants identified the web-apps that they used most frequently used when the focus groups were conducted and why they liked those web-apps in particular. The web-based applications they described fell into 2 categories: connecting applications and utilitarian applications that “help you do stuff [for] work, school, and life.” Examples of connecting web-apps included Instagram, Twitter, Facebook,
WhatsApp, Snapchat, Tumblr, Coffee Meets Bagel, Tinder, and OkCupid. Utilitarian web-apps included banking apps, money transferring apps such as Venmo, email apps, calendar, Google Drive, Voice Recorder, Adobe, Con Edison, period tracker applications, and shopping apps that allowed participants to collect points including Starbucks, and Dunkin’ Donuts. Notably, all but one focus group participant described themselves as “tech savvy.”

Motivation to use

Participants from both treatment groups shared that they used the web-app most often out of curiosity when they initially saved the link to their phone, to refresh their own sexual health knowledge, and during high-need instances for a friend or themselves. For example, a participant in the control arm shared, “I remembered I had it on my phone when a friend shared something with me and then it was really useful and I used it to help him. … A friend came out to me in December, last year. He’s uncomfortable about this [because there were] threats [of being] kicked out [of his parent’s home].” When the friend divulged a condomless sex act with someone he did not know well, the GURHL Code participant used the resources listed on the “flier on the web” to help direct her friend to a clinic to be tested.

Benefits

The trustworthiness of the web-app was a dominant theme that arose among all participants. In particular, having the developer’s picture on the website and an explanation of why GURHL Code was created added a level of personalization, motivation, and transparency that contributed to fostering validity and trust for some young women. For example, a participant said, “[the picture] puts a face to the name of ‘who made this;’ other SRH sites are very institutionalized and very formal.” Another added, “The picture adds an element of ‘I’m just like you. I needed this info too and that’s why I made this app and information publicly available,’
that adds an element of trust and relatability.” Some participants also reported that they liked the idea that a woman had developed the app, not necessarily a woman of color.

The direct and clear language of GURHL Code was especially useful and offered a sense of empowerment, especially around newfound knowledge. One control group participant was particularly emphatic about why she liked GURHL Code after having time to explore it:

... I like this app…because it doesn’t have any floweriness to it. There is no trying to make it more acceptable with like pictures or...different things. It’s giving me what I actually need. It’s making me feel more self-sufficient instead of going to ask someone else and expect they know how to help me or something—like, I can help myself.”
—Control condition participant, 5/15

One participant in the intervention group received a herpes 2 diagnosis while she was enrolled in the study. She described what helped her trust the web-app, and highlights the importance of the accessibility and anonymity of GURHL Code during a difficult moment.

When the group was asked whether or not GURHL Code was useful, this young woman, Anna (pseudonym), shared how she was able to learn more about her herpes 2 diagnosis through GURHL Code, which she considered to be a trusted resource:

I think [what helped me trust the information in GURHL Code] was you—knowing that you are a student. I read about you FIRST (emphasis added), and that helped me realize OK, there is an actual person behind this. It was nice being able to put a face and name to the research that was being done. ... I felt like it was a safety zone for me and I didn’t feel stigmatized for that. ...[I] got news from the gyno that shocked me and [I] wasn’t open to talking about it with anyone else and found a brief synopsis about what my gyno [had] told me [on GURHL Code] and then it directed me to Planned Parenthood...because like, I really needed to talk to someone that didn’t know me. I felt a little more comfortable doing it more like that instead of [talking] with someone who did know me. I still haven’t told anyone I know about it. I spoke with someone live and it did help me to settle in with it [the diagnosis] and learn what was going on at the moment, so it did help me to ease a little of [the] stress I had from it… It was like herpes 2 and I didn’t know I had it and I didn’t know you could get it with, like, even using protection. And I didn’t know it was so common, like cold sores are a form of herpes, I didn’t know that...The app did help me to go to reliable sources.
This highlights the need and urgency to speak with someone during a “high-stress” or “oops” moments—specifically with a trusted source. In this instance, Planned Parenthood was reliable both because it was referred and accessed through GUHRL Code and because it was an established reproductive health resource that offered an anonymous person to talk to.

To highlight the utility of GURHL Code, a control participant discussed the difference between using Google and GURHL Code for health information, whereby with Google, “you are on your own, on GURHL Code you’re guiding me”, here, the respondent was referring to the vetted information collected and presented by the developer on the full version of the web-app. Another participant added about why she trusted the information on GURHL Code as opposed to using the Internet, “… [there’s] something comforting that the advice was coming from another educated woman of color...I didn’t feel like you were going to mislead me.”

Regarding other Internet sources, participants reported that WebMD generated more worry and anxiety, than it offered a remedy to their medical query. For example, a participant said, “You go to search one thing and leave thinking you got 10 other diseases.” Another added that searching for health information during stressful moments was not ideal, “[There’s] something about searching when [you are] in [a] state of panic or worry.” For Anna, the Text an Expert (Planned Parenthood chat connection page), STDs—Let’s Get Real, and the Questions, Honest Answers pages were particularly useful. The Questions, Honest Answers section was particularly helpful to participants:

I think these [Ibis cards] are pretty useful because like you [points to another participant] were saying before, these are things that people don’t want to ask their doctor’s themselves especially like, lots of things on here…having pictures like this, like the felatio picture, that’s pretty useful for someone who doesn’t necessarily want to ask but wants to know something about it, so how else are you going to know the information?

—Control condition participant, April 18, 2016
Of note, participants from one of the intervention focus group were keenly aware of race, of the lack of spaces for women of color, and of being bombarded by pictures of White women. They noted that GURHL Code did not do that. The focus group participants appreciated that the developer was a woman of color and that she was conducting the research, and they shared that they found it “comforting” to know that GURHL Code was “made by and with women...[with] similar experiences to [other women of color]” (Control condition participant, May 15, 2017).

Sharing the web-app

Participants conveyed their willingness to share the website with a range of individuals including cousins, friends, sisters, colleagues and clients and in a variety of modes such as Facebook and by sharing the link directly with women. One said, “This is going out to all my friends when I leave [the focus group]!” referring to the intervention GURHL Code version. A participant expressed willingness to share the intervention GURHL Code. She said,

I like that GURHL Code let me take control of my health at a time when so many other people want to control it. And I like that it gave me answers for questions that my community either doesn’t know how to answer, doesn’t want to answer, or are afraid to answer themselves, in which case... like, I can share this with them instead of staying quiet, which is the least helpful thing that should be happening...when you are talking about health.”

—Control condition participant, May 15, 2016

Another young woman who was in a youth development program intended to share the full website with the alumni group, a participant who worked with an adolescent population mentioned she had intentions to share GURHL Code with the population she served, and another respondent wanted to share it with her NYC high school counselor with whom she had maintained a positive relationship. A few participants wanted to share it with parents of adolescents with whom they were connected. Those in the control group did not have intentions to share the “flier on the web”, but did intend to share the intervention version after they saw it.
Some respondents added the caveat that GURHL Code would best serve a younger group or those “sexually less experienced.” A participant shared, “I would refer my younger cousins to it, but I’m not sure I would keep it for the information that’s on here. Except for the clinic search that was VERY (emphasis added) useful for me. I think there are other ways to figure out some of this information.” Some participants discussed the straightforward information and easy-to-understand, non-judgmental language as motivation for sharing the intervention version, “I want to share it with my sister...[the language on GURHL Code] is much more conversational…and not like on [web]sites made for younger women that can sometimes get…‘judgey.’”

**Barriers to using the web-app**

Occasional technical limitations and high knowledge of sexual health were barriers to web-app utilization. Participant SRH knowledge was measured and is explored in the following chapter (chapter 4). When asked if they thought it was important for GURHL Code to be available on the app store as a native app, there was a resounding “yes” from participants. Some reported that when their phone underwent an update while enrolled in the study, their other (native) apps returned but neither the control nor the intervention participants could recall the steps to reinstall the web-app they were assigned (i.e., to bookmark the link and save it to their home screens) which gave it the look and feel of a native app. Other usability issues identified included a participant who reported that she did not understand that clicking on the “+/−“ signs would make the text appear in a pull-down box, and another shared, “I wish that the GURHL Code font was slightly thicker—to make it easier to read on my phone.”

**Structural factors in participants’ lives**

Participants also raised larger systemic issues that may affect motivation for using this sexual health web-app and possibly for participating in sexual health-technology–based research.
Nearly all of the young women reported a lack of sexual health education from family or friends and a need for better sexual health education in New York City. Better sexual health education was characterized as more comprehensive conversations that avoid overly simplification of sexual health, for example, 1 woman said, “[We] want the space to get away from the BS (where sex is trivialized by referring to it as ‘hanky panky.’ ” Young women shared that information from parents was not helpful. One woman described how her mom had to have the sex talk but instead of using anatomically correct terms just used “the thing,” making for a confusing conversation. She also described how that conversation ended in her mother expressing that she did not need to know until she got married, which seemed to be exacerbated because she was the baby in the family. She revealed not being able to talk with her sisters either. Another respondent shared:

My parents never spoke to me about sex and… you know, your parents are your biggest teachers. More often than not I see White parents on TV giving the talk about the birds and the bees and I never got that. I don’t know if that’s the story for most women of color, but I imagine it’s not too different just because of our cultures. I went to a pretty good high-school—it was like, majority White, so I was able to get a decent sexual health education, but I think particularly in neighborhoods that are poorer and have schools that aren’t as good, serving women of color (and boys of color too), they don’t have those programs and that’s usually where you have high rates of teen pregnancy and things like that.

—Intervention condition participant, May 8, 2016

Specific to being educated in NYC, a participant commented that she had a gym teacher who taught English as well as sexual health education, “Someone who it wasn’t their expertise, it was added on to what they had to do,” and another participant remembered sexual health education being “a video in the 7th grade. I don’t remember the video, but I remember it happening.”
Focus group results: findings

Reaction to the overall design

Several differences between the intervention and control groups were noted. The name “GURHL Code” was discussed positively in several ways. First, participants in both intervention focus groups discussed that it did not necessarily make them think of sexual health. They spoke of this as a positive because they appreciated the discretion that the name offered as it did not include “sex” in the name. Finally, the name invoked a “pro-young woman” feeling in tone for some participants. For example, one woman said, “The name of it… I love the name! It means something like an acronym, but it’s ‘gurhlcode’ for girls. Packaged with that is the idea that this [web]site was made by someone who might better understand what we need.”

Although they did not constitute themes, because it was a pilot study, we thought the following quotes were important to inform future work. Participants reacted positively to the overall design. Reactions to the initial use of the intervention web-app from control group participants elicited positive responses such as, “I really like the colors—very eye catching. I like the format, it’s not blocky—it’s more interactive because you can choose what you want to see as opposed to a long website just with words.” This was also a commentary on what they did not like about the “flier on the web” which was a long website one could scroll down. Another control participant shared that she thought it was, “really comprehensive,” while another added that it was, “really powerful...[the] whole thing in one package...it’s a one-stop shop.”

Participants’ recommendations

Regarding content, participants from all focus groups had recommendations for additional content and features. They were clear not to remove any existing content, “I’m looking at all of them [the menu options] and thinking ‘I kinda need all of them.’“
Recommendations included collapsing the Clinic Finder header with Things For the Clinic Visit and Text an Expert; Condoms might be collapsed under Questions, Honest Answers, and It Happened to Me might go under STDs—Let’s Get Real. Some participants suggested also making Text an Expert more prominent by putting it as a running footer so that it appeared on all pages of the app. Participants suggested adding more detailed information on PREP, healthy relationships, consensual sex, birth control information, and abortion myth clarification to make it more comprehensive. Some wanted a period tracker and a brief history on sexual reproductive justice. Additional desired content areas included: how to help a friend cope with an STD diagnosis, step-by-step information on what to do if one experiences sexual assault or pregnancy, including seeking an abortion. Participants suggested increasing interactive features through quizzes, and by adding a monitored support forum or group discussion for women who are facing difficult circumstances regarding sexual and reproductive health issues. Several participants felt strongly about adding an introductory video explaining the GURHL Code research project and what the application does and how one might use it. This recommendation came up specifically because the main page was thought to be too plain and a video would “liven’ it up.” In addition, respondents were sensitive to the fact that the “for women-only space” that GURHL Code provided should be expanded to include specific health information for trans-women, lesbians, and queer women. Finally, participants who were especially aware of race also suggested inserting “Did you know?” entries focused on reproductive health justice and on eugenics to include “teachable moments” for all women.

**DISCUSSION**

Although no standard definition exists, the World Health Organization defines eHealth as “the use of information and communication technologies (ICT) for health” and mHealth is
understood to be a component of eHealth.\textsuperscript{30,31} WHO defines mHealth as “the use of mobile and wireless technologies to support the achievement of health objectives,”\textsuperscript{31} and an mHealth strategy is the application of a technology for a defined health purpose (e.g., text messages to deliver appointment reminders) in order to address specific health system challenges.\textsuperscript{31} We explored the feasibility and acceptability of a web-based sexual health app tailored for young Black and Latina women in New York City aged 18 to 25 drawing from web-analytics, baseline data, and 3-month post-test questionnaires, and focus groups. Given the small sample and the lack of formal usability testing, the results are not generalizable to other communities; however, given the dearth of literature around sexual and reproductive mHealth specifically for Black and Latina women, we believe the focused population of interest is a strength of this study and a contribution to the field.\textsuperscript{47,95}

Triangulating focus group results, survey responses, and web analytics suggests participants were enthusiastic about the availability of the intervention web-app of the GURHL Code Study in comparison to the standard-of-care control “flier on the web.” Focus group responses were positive regarding the colors, direct language, and transparency of the web-app developer. Participants were especially enthusiastic about the step-by-step condom instructions that came with accurate pictures, and about the clear content of the Questions, Honest Answers section. As evidenced by the web analytics behavior path data, the Clinic Finder and Trusted Resources and the connection to the Planned Parenthood chat function (Text an Expert) were utilized less than the anatomy screens (My Parts), however, they were mentioned with greater emotional intensity during focus groups.

Although participants reported that they might not use the web-based app on a daily basis, they were interested in both sharing and keeping GURHL Code. Specifically, respondents
were interested in sharing it with women in their lives who might be “sexually less experienced,” such as younger sisters and cousins, and those who might be connected to younger women, including mothers of adolescent women. This was in part driven by the misinformation imparted by participants’ family members around sexual and reproductive health and sexuality. Focus group participants were interested in keeping GURHL Code on their phones as a bookmark to connect to a provider for “oops” moments (i.e., after a condomless sex act either for themselves or their friends, or after receiving an STD diagnosis), and for refreshing their own sexual health knowledge. Further, we agree with Goldenberg et al. that the language and tone of SRH apps need to strike a balance between a friendly and humorous approach with respected and trustworthy information and tone.205

Study findings suggest that sexual and reproductive health education delivery, including connection to a Planned Parenthood texting feature and finding a clinic in the area, is desirable and feasible via smartphones. Our findings emphasize the need and urgency to speak with someone during a high-stress or “oops” moments—specifically with a trusted and reliable source such as Planned Parenthood. In this study, Planned Parenthood was considered reliable both because it was referred and accessed through GUHRL Code and because it was an established reproductive health resource that offered an anonymous person to talk to. In addition, the young woman who was diagnosed with herpes 2 while enrolled in the study spoke about not having shared her diagnosis with anyone and specifically using the GURHL Code intervention website to: a) learn more about STDs more generally, and her diagnosed STD specifically, b) connect to the Planned Parenthood chat function to speak with someone to “put her mind at ease” about her diagnosis, and c) explore the Who the heck made this app? information and to appreciate that the PI was a highly educated woman. This finding is in alignment with other smartphone health app
studies suggesting mobile health apps may be an effective tool for individuals to manage and cope with difficult situations when other support options are unavailable.\textsuperscript{95} Findings from formative focus groups to tailor GURHL Code for women of color resonated with participants from the follow-up focus groups who spoke about appreciating that the web-app was a “for women-only” zone. Goldenberg and colleagues also found that the MSM who participated in their formative focus groups responded well to the safe space that the web-app could provide if they trusted the app and the app’s creator.\textsuperscript{205}

Survey findings show that, overall, 95% reported some level of difficulty in understanding the health information found on web-apps other than those used for this study, and 75% found the health information on those apps unhelpful. Interaction with the focus group participants and the findings from the survey showed that for this pilot, participants found the web-app acceptable, but that for a future larger scale study or release, they would expect to find the app in the marketplace (i.e., Apple’s App Store and Google Play). This is compatible with the literature around the emotional attachment people have with a high-functioning and well-designed web-app.\textsuperscript{227}

We were unable to detect a difference around usability items; participants in both treatment arms generally found the websites to be easy to use and well organized. However, there were statistical trends regarding ease of web-app use suggesting a greater proportion of intervention participant’s thought the web-app they were assigned was easy to use compared to the control arm indicating that a larger sample size might detect a statistically significant finding, which is considered to be promising given that this was a pilot RCT.\textsuperscript{228,229} Although we cannot compare pages viewed per page to the control website, in comparison to HealthMindr, an HIV prevention web-app pilot for men who have sex with men (MSM), for example, GURHL Code
did not fare well with regards to analytics. The MSM study reported an average user spent an average of 17 minutes and 40 seconds, more engagement by 16 minutes than a typical GURHL Code user. In comparison to 5 web-based studies from a review reporting usage statistics, time spent/session/person ranged from 4.5 to 45 minutes. In our study, participants on the GHURL Code web-app spent an average of nearly 1 minute on the website. This is considerably less time than that noted in a pilot study for MSM, however, given the differences between our intervention and the one for MSM (including target population), such differences should be interpreted with caution. That is, we cannot qualitatively account for whether someone spending 2 minutes in 1 intervention would have less benefit than someone spending 5 minutes engaging with a completely different intervention informed by a different theoretical foundation and covering a different set of topics (by a different target population), and it may be that the GURHL Code content and goals required less time and engagement with the web-app. In fact, low engagement is consistent with the desired use that participants conveyed for “oops” moments and to refresh their own SRH knowledge. Although, GURHL Code web analytics engagement were low, it is critical to learn these lessons during a pilot phase to adapt the intervention for future work and so that others may learn from this work. In addition, despite a non-differential finding when comparing the usability of the control and intervention websites and low analytics, similar to the work of Mustanski, Greene et al. on an online sexual health promotion program for LGBT youth regarding the feasibility and acceptability of eHealth research, we believe it is acceptable that the quantifiable intervention effects were modest given that the intervention had a small dose, the cost of the intervention delivery was low, and the potential for future wide-scale dissemination is high. Some claim that the promise of
eHealth research stems from the potential of intervention impact, defined as the product of efficacy times reach (percentage of population receiving).

Our findings around the user’s experience and the web-app’s trustworthiness and usefulness are an important contribution to the field given the growing, yet limited, body of literature on trust, perceived ease of usefulness for sexual and reproductive mHealth interventions, specifically RCT pilots including young adult Black and Latina women. Further, women had recommendations on how to make a sexual and reproductive mHealth tool more engaging to increase usage. When asked what content to remove, a reoccurring theme was to keep all of the current content and to add information around abortion, healthy relationships, and sexual assault. Dislikes that were mentioned in focus groups were most commonly related to technical issues. Time engagement analytics might be improved by adding some of the content and features that participants mentioned. For example, suggested expanded content included understanding the steps of an abortion and the steps to follow when reporting sexual assault, information on healthy relationships and health-specific information for sexual minority women, including trans-women. Additional features might include gamification elements such as interactive quizzes, and period or condom trackers. Findings from this study suggest that it is appropriate for pilot studies to assess the feasibility and acceptability using a web-based responsive website with the intention of moving to native web-apps (i.e., Apple and Android marketplaces), as there are important lessons to learn in the earliest stages of feasibility mHealth and pilot RCT research.

There was a relatively steep learning curve to coding a responsive website, making changes rather quick and easy for the GURHL Code web-app. Having the web-app available also allowed users to beta-test an advanced live version as opposed to sketches that are often used in
early prototyping.\textsuperscript{212,233} Women who participated in the focus groups were clear that they expected to find GURHL Code in the marketplace and that they were comfortable with a simplified version of the application for a pilot, but that they expected expanded future versions to include additional functionality and content with regular updates on a native web-app (found through Google Play or the Apple App Store). Web-apps are likely to transform health promotion as well as healthcare delivery and ongoing health monitoring.\textsuperscript{234}

Public health and other providers and researchers are drawn by the potential for mobile technology because it is a way to reach younger populations.\textsuperscript{235} There is rapid proliferation of mobile health tools being used to connect the public to health information and services (i.e., web-based apps, wearables).\textsuperscript{227} However, many health-technology tools struggle with uptake, dissemination, and with how to make something that users will not only use initially, but continually.\textsuperscript{227} In addition, technological innovations change rapidly and researchers are unable to stay apace given the time it takes to seek funding, conduct longitudinal research, and disseminate results.\textsuperscript{57,142} We are still learning about the potential of different types of technology with respect to tailored approaches for select populations and scalability for broad dissemination. This study contributes to a growing body of knowledge specifically for young Black and Latina women and takes advantage of the portability and around-the-clock availability of information,\textsuperscript{236} a limitation of other health-technology interventions targeting young women.\textsuperscript{47}

This study suggests that incorporating a user-centered approach to developing these tools could help generate technology that is needed and that will be utilized. The design-thinking approach and the use of an active community advisory committee were successful approaches in creating something that young women between 18 and 25 years of age who identify as Black and/or Latina found relevant and informative.
Limitations

There were several limitations to this study. First, web analytics: despite using a setting to limit the web-apps searchability on search engines (such as Google), both the intervention (gurhlcode.org) and the control web-apps had visitors from all over the world during the study period from October 7, 2015 to April 14, 2016, likely due to a search engine result. It was problematic for this RCT that 66 countries outside of the United States had accessed the web-app, because it meant that the analytics being analyzed were not solely reflective of the study population. To address this, we only examined the analytics for New York City and for women; however, it is still possible that our web analytics data included individuals who were not participants in this study as we could not link activity to individual participants. In addition, gender is determined from information provided to a Google account or to a Google Partner (i.e., YouTube), or gender is estimated based on a combination of self-reported data and on Internet browsing data (which is collected from a cookie Google uses to store information on browsing behavior).\textsuperscript{237,238} The estimation that Google generates could be impacted by ad blockers that potentially prevent the cookie from firing, or, when cookies are cleared by users all data is lost and Google restarts assembling user’s profiles.\textsuperscript{237} Finally, Google is known to use only a subset of data to compile reports, meaning that a larger sample of data is more likely to yield a more accurate portrait of users’ demographic profiles. Given analysis of a relatively small sample for a relatively short amount of time, this data should be interpreted cautiously.\textsuperscript{237} Future researchers might consider adding login options or password controls so that only study participants can gain access. That being said, instituting such controls could make the experience more difficult for participants (who might forget their log-in credentials, for example).
Only a single user was recorded as viewing both web-apps from the same IP address, indicating very low contamination from single IP addresses. We acknowledge that the same user could have viewed the 2 web-apps from different devices or over a classmates’ shoulder and thus have introduced contamination. Two of the 4 focus groups were mixed, meaning that both intervention and control group participants attended. In those cases, those from the intervention group were asked to share their experiences and responses to questions after control group participants to reduce bias.

We acknowledge that, by design, the intervention page had more content to view versus the control page, and while the comparison yielded a statistically significant difference, findings should be interpreted cautiously. The design essentially increased the opportunity for participants to engage with more content, skewing user engagement data. That said, we were encouraged by the lower bounce rate for the intervention web-app compared to the control web-app. In addition, the proportion of returning users (45.4% for intervention web-app versus 31.5% on the control web-app) suggests that the content was helpful, regardless of the differences of presentation. The lack of formal usability testing has resulted in partial findings; however, as this was a feasibility and acceptability pilot study, focusing on refinement is acceptable as we work towards developing a native Apple or Android application and expanding the mHealth GURHL Code study.\textsuperscript{31,33} Future formal usability testing will include participants attempting to complete a task while researchers watch, listen, and take notes in order to refine the ease with which the tasks are accomplished.\textsuperscript{211,239} Other well-documented expert-based (e.g., heuristic evaluation, cognitive walkthrough) and user-based usability testing, the think aloud approach, will also be employed. These usability testing methods allow researchers to collect observations about the pathways participants take to address a proposed task, problems that are experienced, comments and
recommendations that users make, and responses to open-ended questions during the usability testing session.²¹¹,²⁴⁰ A systematic review of the empirical studies on usability of mHealth apps found questionnaires, interviews, logs, and the “think out loud” methods to be employed.²⁴¹ In keeping with the recommendations of this systematic review, we anticipate our own future usability methods to use automated evaluation tools such as eyetracking techniques.²⁴¹ Regardless of the specific methods selected, we will be careful to combine different complimentary techniques, which are reportedly more powerful than when the methods are applied in isolation,²¹¹,²⁴¹ and to be mindful of the most updated mHealth reporting conventions, such as the mHealth evidence reporting and assessment (mERA) checklist developed by the WHO mHealth Technical Evidence Review Group.²⁴²

An unanticipated technical challenge was that a few women reported losing their GURHL Code icon when their phone shut down to run an update. One participant reached out during the study because she was unable to get the Text an Expert function to appear on her Windows phone. Planned Parenthood Federation of America staff provided instruction for this participant to hold her phone in the landscape position for the Text an Expert features to work properly on her phone. Furthermore, additional code was added on the backend of the web-application after this instance to instruct users to hold their phones in the landscape position to prevent this error from occurring for future users. Although the Text an Expert feature worked on most phones tested (a range of Apple and Android devices), we were unable to test all phone types in use.

**CONCLUSIONS**

Given the desire of participants to share the web-app with less sexually experienced women, there may be an opportunity to expand future research to include a broader age range of
women and to tailor the research for different women by creating a suite of web-applications to include younger-aged women or even to expand to an application for parents of daughters. A web-based application for parents could offer SRH education and possibly language they might practice around sexuality and sexual and reproductive health they could use with their children for conversations known to be embarrassing for parents or for conversations they simply do not know how to have. A tool to foster good communication and comfort between parents and adolescents about sexual issues would be especially relevant given Diiorio and colleagues’ findings that if an adolescent talks more with the mother about sexual issues than with friends, they are less likely to initiate sexual intercourse and more likely to have conservative values. In addition, a suite of web-apps tailored for several groups would be appropriate given that prior research around participants’ receptiveness toward mHealth apps appeared to transcend age and educational level. Moreover, to address the dearth of mHealth tools tailored for Latinos, these tools should be made available in easy-to-understand language in both English and Spanish with particular usability focus on ensuring cultural congruence; they should also include illness beliefs and attitudes toward medical professionals and be sensitive to preferred intervention delivery. Future analysis will explore preliminary efficacy on sexual health knowledge with this data set; additional full-scale studies are warranted.
Figure 1. GURHL Code Intervention Screen Shots

- Text an Expert
  More than 1/2 of sexually active people will get HPV in their lifetime. See your doc to get checked out.

- It happened to me
  “Nothing is impossible, the word itself says ‘I’m possible’!”
  - Audrey Hepburn

- STDs – Let’s Get Real
  You are beautiful, let’s talk about how to take care of you.

  +/- First, a word about STDs…
  +/- Who’s got a STD?
  +/- FAQs about STDs

- Condoms
  “We may encounter many defects but we must not be defeated.”
  - Maya Angelou

  Before you jump into bed, check out this info (with pictures) to see how to properly put on a male and female condom.

  Don’t forget the lube, … & have fun...

  +/- Male Condom
  +/- Female Condom
  +/- Source

- Anatomy
  Anyone can get HIV regardless of age, race, gender, sexuality or choice of sexual partners, so protect yourself by always using condoms.

  Knowledge is power.

  How many holes do women have? If you don’t know, check these videos. We get that they are a bit technical, but we thought they provide some good information that all women should know about their bodies.

  These will work best if you have wifi.

- Cervix

  Created by: Ribs Reproductive Health with funding from: The Ford Foundation.
Here's a short list of a few websites you can trust for reproductive and sexual health info. Scroll down for a short list of where to go in NYC.

Easy to Understand & Trusted Web Sites
- Go Ask Alice: www.askalice.columbia.edu
- Teen Health: www.teenhealth.org
- Planned Parenthood: www.plannedparenthood.org
- NYC Department of Health & Mental Hygiene: www1.nyc.gov
- NYC Women’s Center: www.womenscenter.org
- Teen Health Exchange: teenager@exchange.org
- Sexwise Birth Control Boutique: https://sexwise.org/boutique

There are lots of other options. These are just a few places where we think you might have a good experience for your sexual and reproductive health. If we’re wrong, please send us a note using the form at the bottom of this page.

Brooklyn
HEAT Program
718-487-4446
Free and confidential reproductive & sexual health services ages 11-24 year old
Heights glycine, Inc.
421 Ocean Ave at 57th Ave 11308
Planned Parenthood Brooklyn
1-800-230-PLAN
plannedparenthood.org/newyork
44 Court Street 6th Floor at Borough Hall 11201

Bronx
Adolescent Clinic at Children’s Hospital at Montefiore Medical Center
718-741-2490
mmaj-01@montefiore.org
3415 East 167th Ave, 4th Floor (212) 318-1045
Community Healthcare Network’s Tremont Health Center
718-294-0361
chhn.org/locations/tremont-health-center
3415 East 167th Ave, 4th Floor (212) 318-1045
Institute for Family Health - Mount Hope Family Practice
718-593-9900
1303 East 167th Ave at Van Nest Ave 10469
Planned ParenthoodBronx
212-965-7000
plannedparenthood.org-health-center-name-yorkbronx
3465 East 167th, 2nd Floor at Concourse Ave 10451
Urban Horizons Family Health Center
718-283-0000
90-98 East 168th St at Ocean Ave 10463

Manhattan
Callen-Lorde | Health Outreach to Teens (HOTT)
LGBTQ adolescent and young adult reproductive and mental health program targeting homeless youth.
212-271-7200

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Figure 2. GURHL Code Control One Page Screenshot
Figure 3. Consort Diagram

Did not consent
$n = 9, 1.5\%$

All recruited
$N = 583, 100\%$

Dropped off
$n = 82, 14.1\%$

Did not complete survey in full
$n = 243, 49.4\%$

Consented to screen
$n = 492, 84.4\%$

Screened ineligible for study
$n = 91, 18.5\%$

Eligible and did not consent
$n = 16, 3.2\%$

Eligible and provided consent
$n = 140, 28.5\%$

Completed survey
$n = 122, 87.1\%$

Did not complete survey
$n = 18, 12.9\%$

Not reached to complete enrollment
$n = 8, 6.6\%$

Completed enrollment
$n = 114, 93.4\%$

Intervention
$n = 61, 53.5\%$

Control
$n = 53, 46.5\%$

Did not complete post-test
$n = 4, 0.07\%$

Completed post-test
$n = 57, 93.4\%$

Completed post-test
$n = 48, 90.6\%$

Did not complete post-test
$n = 5, 0.09\%$
| **Clinic Finder and Trusted Resources** | An option to search for nearby clinics using a database maintained by Bedsider (National Campaign to Prevent Teen Pregnancy) for a list of health centers and birth control providers. Information includes hyperlinks and clickable information that can then be opened using other web-apps and websites such as telephone numbers, and geo-location maps. |
| **Things for the Clinic Visit** | A simple list of items needed for a clinic visit, including items one may need if asking for financial assistance. |
| **Text an Expert** | An option for a participant to connect to a National Planned Parenthood health educator. |
| **It Happened to Me** | Two audio stories by a woman and a man about how they contracted HIV as young adults and are living with HIV in NYC. |
| **STDs—Let’s Get Real** | Clear and medically accurate information on STDs. |
| **Questions, Honest Answers** | Questions and answers created by Ibis Reproductive Health in order to assist health care personnel to respond to young women’s concerns around sexuality and sexual health. |
| **Condoms** | An educational website that provides information on how to properly put on a condom which includes both text descriptions and pictures of male and female condoms. It also directs users to where they can find free condoms in NYC. |
| **My Parts** | A basic educational video on reproductive female and male anatomy. |
| **Who the heck made this app?** | A brief description of how the web-app was made and by whom. |
| **Did you know?** | Rotating factoids on STDs and self-empowerment quotes and messages at the top of each page. |
Table 2. Demographic and Sexual Behavior Characteristics of Final Sample (N = 105)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Intervention</th>
<th>Control</th>
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<td>College degree to Master’s degree</td>
<td>28</td>
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<td>US-Born</td>
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<td>77</td>
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<tr>
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<td>17</td>
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Table 2. Demographic and Sexual Behavior Characteristics of Final Sample Continued

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<td>Neither parent US-born</td>
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<td>1 parent/person who</td>
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<td>Neither went to college</td>
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<td>Last sex act (select all that apply)</td>
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<td>6 or more partners</td>
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<td>18</td>
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<td>Number of standard drinks on a typical day</td>
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<td>74.2%</td>
<td>16</td>
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<td>3 or 4 drinks</td>
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<td>4</td>
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<tr>
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<td>Drug use before last sex act</td>
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<td>Buzzed or drunk at last sex</td>
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Table 2. Demographic and Sexual Behavior Characteristics of Final Sample Continued
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<th>SD</th>
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<th>SD</th>
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<th>t-test</th>
<th>p</th>
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*Missing values were excluded from significance testing.*
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<th>Total n</th>
<th>%</th>
<th>Intervention n</th>
<th>%</th>
<th>Control n</th>
<th>%</th>
<th>Test Statistic</th>
<th>p value</th>
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<td>26.3%</td>
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<td>Thought app was easy to use</td>
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<td>Found app complicated</td>
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<td>Found app functions and features to be well organized</td>
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<td>15.8%</td>
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<td>Thinks will share app with a family member</td>
<td>105</td>
<td>99.1%</td>
<td>68</td>
<td>64.8%</td>
<td>36</td>
<td>63.2%</td>
<td>$\chi^2 = 0.14$ (1)</td>
<td>$p = 0.70$</td>
</tr>
<tr>
<td>yes</td>
<td>68</td>
<td>64.8%</td>
<td>36</td>
<td>63.2%</td>
<td>32</td>
<td>66.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>37</td>
<td>35.2%</td>
<td>21</td>
<td>36.8%</td>
<td>16</td>
<td>33.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thinks will share app with a friend</td>
<td>105</td>
<td>99.1%</td>
<td>72</td>
<td>69.2%</td>
<td>36</td>
<td>64.3%</td>
<td>$\chi^2 = 1.39$ (1)</td>
<td>$p = 0.23$</td>
</tr>
<tr>
<td>yes</td>
<td>72</td>
<td>69.2%</td>
<td>36</td>
<td>64.3%</td>
<td>36</td>
<td>75.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>32</td>
<td>30.8%</td>
<td>20</td>
<td>35.7%</td>
<td>12</td>
<td>25.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>missing *</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Missing values were excluded from significance testing.
Table 4. Web Analytics

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Control</th>
<th>Intervention</th>
<th>Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>M (SD)</td>
<td>n</td>
</tr>
<tr>
<td><strong>Descriptive analytics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pages viewed/session</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–3 pages per session</td>
<td>-</td>
<td>-</td>
<td>361</td>
<td>96.52%</td>
</tr>
<tr>
<td>4–6 pages per session</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>1.34%</td>
</tr>
<tr>
<td>7–9 pages per session</td>
<td>-</td>
<td>-</td>
<td>8</td>
<td>2.14%</td>
</tr>
<tr>
<td><strong>Comparative analytics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sessions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–2 sessions during study period</td>
<td>156</td>
<td>54.6%</td>
<td>88</td>
<td>58.3%</td>
</tr>
<tr>
<td>3–4 sessions during study period</td>
<td>74</td>
<td>25.9%</td>
<td>38</td>
<td>25.2%</td>
</tr>
<tr>
<td>5–6 sessions during study period</td>
<td>28</td>
<td>9.8%</td>
<td>13</td>
<td>8.6%</td>
</tr>
<tr>
<td>more than 7 sessions during study period</td>
<td>28</td>
<td>9.8%</td>
<td>12</td>
<td>7.9%</td>
</tr>
<tr>
<td><strong>Average sessions Per User (seconds)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Users</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1–3 users during study period</td>
<td>222</td>
<td>77.6%</td>
<td>125</td>
<td>82.8%</td>
</tr>
<tr>
<td>4 or more users during study period</td>
<td>64</td>
<td>22.4%</td>
<td>26</td>
<td>17.2%</td>
</tr>
<tr>
<td>Bounce rate with users as an n</td>
<td>1001 (users)</td>
<td>93.9%</td>
<td>1077 (users)</td>
<td>85.6%</td>
</tr>
<tr>
<td>Measures</td>
<td>Themes</td>
<td>Responses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of reading the material from their screen, whether participants</td>
<td>Intervention participants remembered and liked the web-app visuals and name, especially the colors used</td>
<td>The name of it… I love the name! It means something like an acronym, but it’s gurhlcde for girls. Packaged with that is the idea that this site was made by someone who might better understand what we need.” Gurhlcde doesn’t necessarily make you think of things of that nature. — Intervention condition participant, 5/8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>liked the font, colors and general web-app design, (Intervention</td>
<td>Control participants had generally positive initial reactions</td>
<td>I really like the colors—very eye catching. I like the format, it’s not blocky—it’s more interactive because you can choose what you want to see as opposed to a long website just with words. — Control condition participant, 4/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>feasibility and acceptability measures)</td>
<td></td>
<td>…really comprehensive — Control condition participant, 5/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation to use assigned web-app during the study period</td>
<td>Initial use curiosity</td>
<td>…really powerful… whole thing in one package… it’s a one-stop shop. — Control condition participant, 5/15</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Refresher on information</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>High need instances: To help a friend</td>
<td></td>
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<td></td>
<td>Self-help</td>
<td></td>
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</tr>
<tr>
<td>Perspectives on the web-apps’ usefulness, and trustworthiness</td>
<td>Personalization, motivation, and transparency fostered validity and trust</td>
<td>[the picture] puts a face to the name of “who made this;” other SRH [sexual reproductive health web] sites are very institutionalized and very formal. The picture adds an element of “I’m just like you and I needed this info too and that’s why I made this app and information publicly available” that adds an element of trust. — Control condition participant, 5/15</td>
<td></td>
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</tr>
<tr>
<td>Participants liked the idea that the web-app was developed by a woman, not necessarily a WOC</td>
<td>I would trust the info even if it was a White woman who made this. It’s more about the motivation “who you are and why you were doing this” versus ‘the complexion. —Intervention condition participant, 5/8</td>
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<tr>
<td>Trustworthiness of GURHL Code vs. other Internet sources</td>
<td>… [comforting to know that] it was made by and with women [with] similar experiences to you. —Control condition participant, 5/15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participants reported a sense of empowerment, especially with new knowledge</td>
<td>I like that GC allowed me to explore what I know about sexual health and what I didn’t know, so that I can navigate what I wanted to find out. Even with the questionnaire, I had to think about what was going on—I had to reflect on my thoughts and it really blew my mind as to how much I didn’t know about sexual health. —Control condition participant, 4/18</td>
<td></td>
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<tr>
<td></td>
<td>… out there [on the Internet/using Google] you are on your own, on GURHL Code you were guiding me.” —Control condition participant, 5/15</td>
<td></td>
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<tr>
<td></td>
<td>“… [there’s] something comforting that the advice was coming from another educated woman of color...I didn’t feel like you were going to mislead me.” —Control condition participant, 5/15</td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>“In a way, it was way more comforting to me to come here because I had a face of who made the [web]site versus like an unknown source as opposed to using a dot com that could be some man from Minnesota who has no idea about sexual and reproductive health. Not so much the aesthetics, but it was like there is someone behind this giving factual information that’s not like [beating] around the bush.” —Intervention condition participant, 5/8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>…back to why I like this app is because it doesn’t have any floweriness to it. There is no trying to make it more acceptable with pictures or like...different things. It’s giving me what I actually need. It’s making me feel more self-sufficient instead of going to ask someone else and expect they know how to help me or something—like, I can help myself. —Control condition participant, 5/15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The site helps you feel self-sufficient and don’t have to rely on what hear from school or what you hear from a friend who may be misinformed and give you inaccurate information. —Control condition participant, 5/15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I liked that GC let me make my own decision about what I wanted to see and gave me options instead of just being thrown all this different info. —Control condition participant, 4/18</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>I think these [Ibis cards] are pretty useful because like you were saying before, these are things that people don’t want to ask their doctor’s themselves especially like, lots of things on here. So like, having pictures like this, like the</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
felatio picture, that’s pretty useful for someone who doesn’t necessarily want to ask but wants to know something about it, so how else are you going to know the information? —Control condition participant, 4/18
ABSTRACT

Despite a decrease in the proportion of HIV diagnoses in the United States among women, approximately 20% of HIV incidence occur each year among young women. The widespread usage of mobile devices has facilitated the public’s ability to access information whenever and wherever desired, including information on sexual and reproductive health. This pilot randomized controlled trial evaluated preliminary efficacy of a web-based app designed to increase knowledge of HIV and other STDs and to facilitate awareness and use of SRH care via a texting function and a clinic search tool. Inclusion criteria were self-identified Black or Latina women aged 18 to 25, who owned a smartphone, were living or working in New York City, and reported vaginal or anal intercourse with a male partner in their lifetime. Participants were randomly assigned to use either the intervention or standard-of-care web-based app and were administered assessments at baseline and at a 3-month follow-up. To explore preliminary efficacy, analyses additionally compared self-report reproductive health services and SRH knowledge using t-tests, chi-square, or Fisher’s exact tests, as appropriate. The study found high retention rates, successful randomization, and non-differential findings on knowledge or connection to care. Additional full-scale studies are warranted.

BACKGROUND

Black and Latina adolescent and adult women account for nearly 80% of HIV diagnoses in the United States among women. As researchers struggle to decrease HIV incidence among and to reach young women of color, the use of a tailored smartphone-enabled web-based
application (web-app) may offer innovative techniques to help prevent HIV, STDs, and other negative sexual and reproductive health (SRH) outcomes (e.g., unintended pregnancy, infertility). For example, Latinas are less apt to receive regular Pap tests. Delaying health-seeking behaviors has long-term consequences; in fact, Latinas suffer a disproportionate mortality rate from breast and cervical cancers. In addition, Latinas’ documented delay in seeking healthcare may also deter important opportunities to ask sexual health-related questions and to perform STD testing and other screenings. Mobile health (mHealth) could serve as an important bridge to educate women about sexual and reproductive health issues, including HIV and other STDs.

Smartphones provide advanced computing options such as web-based applications, built-in GPS systems, and Internet access, and have impacted how one communicates and seeks information. In 2015, 70% of Black adults and 71% of Latino adults, compared to 61% of White adults, owned a smartphone; 67% Blacks and 73% of Latinos versus 58% of Whites used their smartphones to seek information about a health condition. In addition, analyses of the 2011–2014 Health Information National Trends Survey (HINTS) estimated that 1 in 3 US adults use the Internet to diagnose or learn about a health concern. Given the rapid adoption rate of smartphones among Latinos and Blacks, opportunities to utilize these technologies for HIV and STD prevention may exist. Smartphone applications offer portability and autonomy (allowing for access at the user’s desired location and time); cost-effectiveness and content standardization (technology reduces need for staff-related costs); and includes interactive delivery of health information. App downloading remains concentrated among young adults and those living in urban areas. In addition, younger adults living in urban areas are more
likely to report downloading an app that helps them track or manage their health compared to those in urban areas over 30 years old.\textsuperscript{250}

Characteristics that make mHealth tools well suited for public health intervention include their scalability (that is, potential for widespread use, a goal of translational science) at a relatively low cost (making implementation of the intervention for translational science achievable), tailoring, interactivity, personalization, and delivery at a desired dosage (i.e., message repetition).\textsuperscript{32} Many mobile health (mHealth) interventions are currently available for influencing behavior change, tracking and sharing data, lifestyle education and management, and continuing professional education tools.\textsuperscript{24,64} Sexual mHealth research\textsuperscript{196–204} suggests that technology may offer inroads for reaching young adults to promote positive sexual and reproductive health outcomes; however, there is limited in-depth data,\textsuperscript{23,24} especially for young women of color.\textsuperscript{47}

mHealth interventions intended for women have ranged from addressing pregnancy,\textsuperscript{65–67} including a study on nutrition and pregnancy,\textsuperscript{68} to addressing iron deficiency in premenopausal women.\textsuperscript{82} mHealth studies targeting African American women have included a study for women at high risk of adverse birth outcomes,\textsuperscript{65,83} and Wingood and DiClemente’s suite of group level Center’s for Disease Control and Prevention Diffusion of Evidence-based Interventions (DEBI’s) that were adapted for computer-delivered usage, are intended for African American women. Sisters Informing, Healing, Living, and Empowering (SiHLE) Web\textsuperscript{48,85} was designed for women 14 to 18 years old, Women Involved in Life Learning from Other Women (WiLLOW)\textsuperscript{48,85} was designed for HIV positive women, and SAHARA,\textsuperscript{86} the computer version of the Sisters Informing Sisters on Topics about AIDS (SISTA)\textsuperscript{87} program, targeted adult women. SiHLE Web, WiLLOW, and SAHARA have all shown trends in the right direction at preliminary
efficacy stages regarding fewer proportions of condomless sex acts, and greater sexual communication self-efficacy. (WiLLOW), and SiHLE Web demonstrated an increase in sexual health knowledge. In a randomized controlled trial of 238 high-risk, predominantly African American young adult women in the urban Northeast, 12 weekly video episodes or HIV risk reduction written messages sent to smartphones showed promising results as a new innovative health intervention delivery. However, the focus of this study was on content delivery and did not explore clinical services utilization factors.\textsuperscript{52,84} In addition, the 12-week video study and SiHLE Web, WiLLOW, and SAHARA required participants to travel to a clinical or community site to engage with the technology, and required personnel to deliver the intervention content. We found no mHealth studies that have focused on Latina women and none that measured an increase in utilizing clinical services.

This study explored the use of smartphones and whether access to a sexual and reproductive health (SRH) web-app co-developed with and for Black and Latina women aged 18 to 25 years would impact SRH knowledge and self-report linkages to SRH clinical services at 3-month follow-up assessments.

METHODS

Overview

Data for this study were taken from Guide to Understanding Reproductive Health for Ladeez (GURHL) Code, a randomized 2-group pilot study (Intervention and Control, described below) to test the feasibility and preliminary efficacy of an online smartphone application designed for Black and Latina women aged 18 to 25 in New York City. The intervention consisted of a web-based application, or a website that was designed with a mobile user in mind, to promote connection to clinical services and to improve sexual health knowledge; the control
consisted of another website, also designed with a mobile user in mind, but without active hyperlinks. The control website contained a listing of clinic information and a list of trusted sexual and reproductive health web resources, but was essentially a single page that users could scroll down. To help ensure cultural relevance, a community advisory committee was consulted to finalize the look, feel, and content of each form of recruitment (banner ads, recruitment emails, fliers). The web-app development process and details about the community advisory committee are described in Chapter 1. Measures on demographics, health risk behaviors, understanding other web-based applications, linkages to sexual and reproductive health services and knowledge were measured at baseline and at a 3-month follow-up. The study also sought to better understand barriers to recruitment, enrollment, and retention to inform future studies. As a pilot, it was designed to detect statistical changes around sexual health knowledge by treatment arm but not changes in behavioral outcomes, including linkages to sexual and reproductive health clinical services.

**Participants**

To be eligible, participants had to: self-identify as a woman between 18 and 25 years old, and as either Black and/or Latina; own a smartphone (i.e., a phone capable of accessing the Internet); live or work in NYC; and have reported vaginal or anal intercourse with a male partner in their lifetime. Pregnant women and mothers of children aged 2 or younger were ineligible to participate in the study because these experiences may have made them more likely to seek or use sexual or reproductive health services. Additional exclusion criteria included only being sexually active with women (ever), or being unable to read English.
Recruitment and procedures

Women were recruited via paid online banner ads on a social network website and an online dating website, and via emails that included an attachment of a recruitment flier similar to what was displayed on the banner ads. The emails were sent to youth-serving community-based organizations and professors at local colleges, including fourteen 4-year schools, 4 community colleges, and campus clubs and organizations (i.e., STEM groups, volunteer focused groups, and student government) to be passed on to potential subjects either electronically or as a physical flier; each source for the emails was chosen on the advice of the advisory committee. Recruitment fliers and banner ads included the study logo, described the study (i.e., using a sexual health app on a smartphone for 3 months, baseline and post-tests, optional follow-up focus group), advertised remuneration up to $70 for participating in all research components, and directed participants to the online eligibility screening survey (sample images and other recruitment details are detailed in Chapter 2).

To enroll in the pilot randomized controlled trial (RCT), participants first completed the online eligibility screener, then completed the baseline survey, and then submitted a screenshot of the web-app saved as a bookmark on their phone to the study email address or study phone number. Research staff followed up via text or phone with those who had trouble completing this last step. After completing an online screener survey, providing consent, and completing a baseline assessment, a pre-generated random number assignment process available in the online survey program Qualtrics randomly and evenly distributed participants into each study arm. Chain randomization\footnote{213} was utilized to prevent contamination. That is, a question was asked during the screening survey regarding their recruitment source and when participants self-reported they were referred from a friend or from the same professor, they were assigned to the
same study arm as others with the same referral source. This was decided by the initial randomized participant from that group as assigned by Qualtrics. A similar process was employed for professors: the first person to report a professor referred them to the study was then randomly assigned to either condition, subsequent students identified from that classroom were all assigned to the same arm. Participants were asked to complete a post-test after 3 months. All procedures and recruitment materials were reviewed and approved by the City University of New York Institutional Review Board (protocol # 381039).

**Description of Intervention Condition**

The GURHL Code web-app content was informed by 15 years of public health practice, community advisory committee (CAC) input, and formative focus group feedback. Content was also provided by Bedsider, a program of The National Campaign to Prevent Teen and Unplanned Pregnancy, for the web-app to connect users to clinics by providing the clinic name, a brief description of ages and specific populations served, hyperlinked telephone number, clinic website, link to “find on Google Maps,” and the physical address; all hyperlinks were active so that users could click a button and then have them opened in another app on their device (e.g., the telephone link would generate a pop-up prompt asking if the user wanted to use an app already installed on their phone or computer to dial that number, similarly, clicking the geo-location hyperlink automatically opened the link in Google Maps). Ibis Reproductive Health, an international clinical and social science SRH research nonprofit organization, gave permission to use their “Answering Difficult Questions: A Guide to Address Young Women’s Sexual Health Concerns,” a resource intended for assisting health care personnel to respond to young women’s concerns around sexuality and sexual health. National Planned Parenthood of America provided code to link participants to their web-based feature to chat with a national health
educator. The web-app was coded using HTML, CSS, PHP, and Javascript on a WordPress mobile-friendly website. Content was then refined after pretesting the web-app with a national sexuality trainer and a local physician for adolescents. The intervention arm received this web-app as a responsive and interactive sexual and reproductive health (SRH) web page that functioned as an app on an iPhone or Android Smartphone. Content areas are described in Table 1.

**Description of control condition**

The control condition was also a web-app developed in HTML and CSS on a WordPress mobile-friendly website and, similar to the intervention web-app, functioned as an app on an iPhone or Android smartphone after it was bookmarked to the home screen. However, the content of the control website was a “flier on the web” and served as the standard of care. It contained information that had been prepared and disseminated at health fairs in New York City. It listed clinics’ telephone numbers, physical addresses (with cross streets), websites, if available, by borough, and had a long-page website design. The control website also included a list of trusted websites, and a form to contact clinics was provided at the bottom of the page. With the exception of the “send” button on the contact form, no information on the static page had live hyperlinks.

**Sample size determination and power**

The study was designed to assess the acceptability and possible impact of a sexual and reproductive health smartphone app for young Black and Latina women between 18 and 25 years old in NYC. It also aimed to understand barriers to recruitment, enrollment, and retention for this novel intervention; these are important considerations to inform future evaluations of app-based sexual health interventions, especially regarding assessing and preventing contamination. The
study was powered to detect a statistical difference in the knowledge outcomes. This pilot study was not designed to detect significant changes in behavior or health outcomes as a result of the intervention, as is common and acceptable in pilot studies. As with other feasibility studies, the sample size enabled reporting trends, but was not powered to detect significant differences between groups. For the linkages to clinical SRH services outcome, the power calculation demonstrated that unless the effect sizes are very large, the study will be significantly underpowered.

This pilot RCT sought to recruit 110 enrollees (55 assigned to each study arm) and assumed 9% attrition after 3 months. We also assumed a baseline 1-year history of sexual and reproductive health clinical service use rate of 33.15%. For this power calculation, we used the prevalence of the 1-year utilization of STD treatment, testing, and counseling of a health clinic-administered test estimated from the 2008–2010 National Survey of Family Growth as an estimate of baseline clinic use. Among women aged 20–24, the prevalence of clinic-based pregnancy test use in the past year was 28.4% for Latinas, 37.6% for non-Hispanic Blacks, compared to 29.5% for non-Hispanic Whites. Our study sample includes 18 and 19-year-olds; therefore, this sample may have a lower prevalence of sexual intercourse and thus may also have a lower prevalence of pregnancy test use. For this reason, we assumed a 15% 1-year history of clinic use prevalence to calculate the power of a projected final sample size of 100. A sample of 100 divided between 2 groups with a 2-sided distribution would yield 80% power at the 0.05 alpha level when there is a difference in proportion going from 0.15 to 0.40. For a smaller difference, from 0.15 to 0.30, we will be underpowered at 40%.
Measures

The primary knowledge outcome was the change in knowledge score on 4 sub-scales, condom knowledge, birth control pills knowledge, STD/HIV risk knowledge, and STD/HIV rates knowledge. We also report the overall sexual health knowledge score as an indicator of treatment group comparability to determine whether the randomization process was successful.

Demographics

Prior to randomization, participants completed a 15- to 20-minute long online survey programmed in Qualtrics. Participants indicated their age (in years), race/ethnicity (Black or Latina), relationship status (married or partnered for more than 1 year [yes/no]), education level (categories included completion of 6th grade, middle to high school, high school diploma, some college, college degree, some post-graduate work, master’s degree, or doctoral degree), college enrolled status (yes/no), employment (full-time, part-time, individual income, student, looking for work, or caregiver), and health insurance status (not insured, private insurance, or public insurance). At post-test, participants were asked to complete a survey identical to the baseline survey, and were additionally asked about family wealth. Participants were asked to think of a ladder representing where people stand in the United States. At the top of the ladder are the people who have the most money and education, and the most respected jobs. At the bottom of the ladder are the people who have the least money and education, and the least respected jobs or no job. Participants were asked where they would place family on this ladder (scale from 1 to 10). Participants were additionally asked if they were US-born (yes/no), and parental country of origin (both parents US-born, 1 parent US-born, neither parent US-born, or don’t know).
Health risk behaviors

Participants indicated their age at first sex (in years), last sex act (oral, vaginal, anal, played with sex toys), condomless sex acts during their lifetime (yes/no) defined as vaginal or anal sex without a condom, or during which a condom had broken or during which a condom had slipped off, acts during their lifetime (yes/no), number of sex partners during their lifetime (categories ranging from 1 up to 26 or more partners), number (1 or 2, 3 or 4, up to 10 or more) of standard alcoholic drinks (definition and an image was shown to clarify meaning) on a typical day, whether they were buzzed or drunk during their most recent sexual encounter (yes/no), and any drug use (of alcohol, cocaine, crystal meth, ecstasy, GHB/GBL, marijuana, Ketamine, heroin/opiates, crack, poppers, acid, or prescription drugs without a prescription) during the last 30 days before/during their last sexual encounter (yes/no).

Understanding other web-apps

To assess comparability of study arms on their understanding of web-apps other than those used for the study, participants were asked at baseline and at the 3-month post-test to indicate whether they had problems understanding health information on web-apps (always, usually, about half the time, rarely, or never), if health information found on web-apps was helpful to them (very helpful, somewhat helpful, neutral, somewhat unhelpful, very helpful), and if they used web-apps to search for sexual health information (select all that apply) related to: their period; sexual anatomy; STD signs or symptoms they, a friend, or family member may be experiencing; pregnancy signs or symptoms they may be experiencing; and help finding a doctor.

Linkages to SRH clinical services

Participants were asked to select all services that they felt they needed in the last 3 months from the following list: STD symptoms or testing, pregnancy testing, HIV testing,
emergency contraception, birth control, abortion, pregnancy planning or fertility issues, advice about sex, and did not need help or services in the last 3 months. We then asked participants about whether or not they were able to get selected services with response options of: not able to get services, spoke with a clinic, doctor, nurse, or other health care provider; made an appointment and was seen by a health care provider; used a text or chat button to connect to a clinic, doctor, nurse, or other health care provider; and used a web-app to locate a clinic, doctor, or other health care provider.

Knowledge

All of the knowledge items were asked at baseline then again at the 3-month post-test assessment. We expected at 3 months for the intervention condition group to have higher knowledge sub-scale scores on knowledge of condoms, STD/HIV risk, and STD/HIV rates. Knowledge domains were selected from validated instruments, the Henry J. Kaiser Family Foundation’s National Survey of Adolescents and Young Adults: Sexual Health Knowledge, Attitudes, and Experiences survey, and the Marin School Questionnaire. Participants were asked how effective they believed condoms and birth control pills were at preventing pregnancy and preventing STDs such as HIV, Gonorrhea, and Chlamydia (very, somewhat, not too effective, not at all effective or don’t know). They were also asked to indicate the proportion of people under 25 they believed would get an STD and HIV in the United States in a year (categorical responses included about 1 in 2000, 1 in 200, 1 in 20, or 1 in 2). Then participants were asked a series of items regarding STDs (responses included strongly agree, somewhat agree, somewhat disagree, strongly disagree, or not sure): unless you have sex with a lot of people, STDs are not something to worry about (correct answer strongly disagree); STDs can only be spread when symptoms are present (correct answer was strongly disagree); if someone
they were dating had an STD, they would know it (correct answer strongly disagree); STDs are a nuisance but do not have serious health effects (correct answer strongly disagree). Additional items asked included: STDs can cause cancer (correct answer True), STDs can cause problems with fertility (correct answer True), and STDs can cause increased risk for HIV/AIDS (correct answer Yes). Given that response options on the 15 knowledge items included a Likert scale, true or false, or yes or no, items were recoded as “0” incorrect and “1” correct.

Analytic plan

Descriptive statistics were calculated to summarize sociodemographic and sexual risk behaviors, and to summarize understanding of other web-based applications among young women in the treatment and control conditions at baseline. To reduce the degrees of freedom for statistical analysis, participants who indicated they were both Black and Latina were collapsed into the Latina category; educational level was recoded as up to some college and above, family wealth was recoded as top half and bottom half of the ladder; number of sex partners was recoded as 1 to 2 partners, 3 to 5 partners, and 6 or more; drinks were recoded to 1 or 2 drinks, 3 or 4 drinks, and 5 to 9 drinks. Differences between conditions were assessed using t tests for continuous variables and Chi square or Fisher’s exact tests for categorical variables. We compared those in the intervention study arm to those in the control arm on individual items regarding sexual health services needed in the last 3 months prior to baseline. Among those who indicated that they needed services, we also analyzed individual items around how women were able to get services for the reasons previously indicated using a Chi square or Fisher’s exact test.

Since knowledge items were based on different validated scales, we conducted exploratory factor analysis on all 15 items outlined above under Knowledge, and then, based on scores and the principle investigator’s prior knowledge, assessed which items formed sub-
The final 4 sub-scales were 1) condoms, which included items regarding condoms’ effectiveness at preventing pregnancy and STDs such as HIV; 2) birth control pills, which included items on the effectiveness of birth control pills at preventing pregnancy, HIV/AIDS, and STDs other than HIV/AIDS; 3) risk for HIV and other STDs, which included items around unless you have sex with a lot of people, STDs are not something to worry about, STDs can only spread when symptoms are present, if the participant were dating someone with an STD, they would know it, STDs are a nuisance but they do not have serious health effects, STDs can cause cancer, STD cause fertility issues (difficulty having children), STDs cause increased risk for HIV/AIDS, and having more than 1 sexual partner at a time increases risk for STDs, like HIV, Gonorrhea, Chlamydia, Herpes, etc.; and 4), STD and HIV rates among youth, which included the item on the proportion of young people under 25 who contract an STD and HIV in a year.

Next, change scores were created by subtracting follow-up mean scores from baseline mean scores for each participant, then logistic regressions were calculated, controlling for the baseline values. Given the power and pilot nature of the study, and given that we found treatment groups to be comparable across demographics, risk behavior, and understanding of other web-based applications, only the treatment condition was entered as a predictor. Using means and t-tests, we examined the difference in change scores from baseline to post-test by study condition.

RESULTS

Sample characteristics and retention

In total, 114 Black and Latina women in New York City aged 18 to 25 years were enrolled and 105 women completed the intervention, a 92% retention rate. Of the 61 participants allocated to the intervention arm, 57 (93.4%), compared to 48 (90.6%) in the control arm, completed the 3-month follow-up assessment, a non-significant difference between proportions.
(the CONSORT flowchart illustrating recruitment and retention proportions by study arm are found in Chapter 3).

There were no statistical differences between study arms on participant demographic characteristics or on understanding of other web-based applications items, indicating a successful randomization process (Table 2 and Table 3). The mean age for the total sample was 22.1 years (SD 2.1). On the whole, the sample included more Latinas (60%) than Black women (40%), 85.7% were enrolled in college, and 68.6% had neither parent born in the United States but 73.3% of participants were US-born, and all but 3.8% had health insurance. Eighty percent of the sample were students \((n = 84)\), 48.6% were employed part-time \((n = 51)\), and 19.1% were employed full-time \((n = 20, Table 2)\). Treatment groups were comparable regarding understandability of other web-based health applications, 95% of the entire study sample reported some level of difficulty in understanding the health information found on web-apps other than those used for the study, and 75% felt that the health information found on those web-apps was unhelpful. Women reported searching for sexual health information on things related to their period (77.1%), reported signs or pregnancy symptoms they may be experiencing (32.4%), sexual anatomy (26.7%), finding a doctor (24.8%), or signs or symptoms of STD participants’ may be experiencing (21.9%). To a lesser extent, participants also reported searching for signs or symptoms of STD a friend or family member may be experiencing (11.4%).

**Linkages to SRH clinical services**

Responses did not differ significantly by study arm on self-report linkages to clinical SRH services that were needed or whether participants were able to get services during the last 3 months (Table 4) among those who indicated that they needed services (valid \(n = 69\)) at 3 months post-test. Most often, respondents reported needing sexual and reproductive health
services for birth control (25.8%), pregnancy testing (15.0%), STD symptoms or testing (10.2%) and advice about sex (10.2%), and to a lesser extent emergency contraception (7.2%), HIV testing (4.8%), pregnancy planning or fertility issues (4.2%), and abortion (1.2%). Participants reported they made an appointment and were seen by a health care provider or spoke with a clinic, doctor, nurse, or other health care provider to address their SRH needs. A total of 15 participants reported using a text or chat button to connect to a provider (n = 5, 5.8%) or using the web-app to locate a clinic or provider (n = 10, 11.5%).

**Sexual health knowledge**

The change in knowledge sub-scales score is the primary outcome comparison for this paper. Factor analysis initially revealed 6 factors, suggesting that they may represent separate concepts. Analysis was further refined to reduce the number of factors to 4 (explaining 18% of the variance). At baseline, there was no difference on overall mean knowledge scores between treatment arms (control group overall knowledge score was M = 9.69, SD = 2.63; intervention group overall knowledge score was M = 9.65, SD = 2.41) suggesting successful randomization. As there were no statistical differences by treatment group, we report results for the entire sample. Overall, knowledge increased, albeit modestly, around the condom knowledge sub-scale (baseline score was M = 0.93, SD = 2.50; post-test score was M = 1.03, SD = 0.86; range was 0 to 2), risk for HIV and other STD knowledge sub-scale (baseline score was M = 5.85, SD = 1.58; post-test score was M = 6.01, SD = 1.65; range was 0 to 8) and STD/HIV rates among youth knowledge sub-scale (baseline score was M = 0.61, SD = 0.60; post-test score was M = 0.65, SD = 0.62; range was 0 to 2). There was a no change for the birth control pills knowledge sub-scale from baseline to post-test (baseline score was M = 2.23, SD = 0.86; post-test score was M = 2.22, SD = 0.75; range was 0 to 3). Table 5 additionally reports t-tests to
assess sexual health knowledge at post-test by study arm assignment on the change score, which included the baseline scores and thus, controls for it (Figure 1). These results indicate a non-differential finding on sub-scales. That said, the intervention group increased their knowledge scores around condoms (intervention post-test score was $M = 1.00, SD = 0.82$; control post-test score was $M = 1.03, SD = 0.91, p = 0.92$; range was 0 to 2) and STD/HIV rates among youth (intervention post-test score was $M = 0.67, SD = 0.63$; control post-test score was $M = 0.63, SD = 0.61, p = 0.22$; range was 0 to 2) sub-scales by more points than did the control treatment group. By contrast, the control condition increased their knowledge scores by a greater difference on the risk for HIV and other STDs sub-scale (intervention post-test score was $M = 5.99, SD = 1.66$; control post-test score was $M = 6.04, SD = 1.65, p = 0.35$; range was 0 to 8). There was no difference on change in birth control pills sub-scale knowledge score.

**DISCUSSION**

In preparation for a large-scale randomized controlled trial, the current study was a single-blind pilot trial to determine the feasibility of participant retention efforts, and assessed the initial efficacy of a web-based sexual health app tailored for young Black and Latina women in New York City aged 18 to 25 between baseline and a 3-month follow-up assessment. We believe the narrow focus of the population is a strength given the dearth of literature specifically around mHealth and young adult Black and Latina women.

GURHL Code completion rates were high and provide preliminary support for the feasibility of a web-based app of STD/HIV prevention intervention. Retention rates at follow-up were noteworthy with 105 of 114 (92%) participants completing baseline enrollment and 3-month follow-up assessment. These were similar to the SiHLE Web pilot RCT that retained 37 of 41 participants (90.2%), suggesting web-based studies with young women of color are
feasible. In addition, the treatment and control arms were comparable across demographic, sexual risk, and understanding of other web-based applications, indicating a successful randomization process. Notably, 95% of the study sample reported some level of difficulty in understanding the health information found on apps other than those web-apps used for the study, and 75% found the health information on apps other than those used for the study unhelpful. Although a non-differential finding by treatment condition, these findings suggest a need for a web-based health application that is easy to understand and useful.

This study found that the intervention and control groups were comparable based on demographics, sexual history, and other risk behaviors, as well as regarding the understandability of other web-based health applications, an indication of a successful randomization process. Specifically, the sample had a mean age of 22.1 year (SD 2.1), and included more Latinas (60%) than Black women (40%). A high proportion of the participants were enrolled in college at the time they took the baseline survey (87%). Reflective of a New York City population, a high proportion were US-born (73.3%) and a high proportion had neither parent born in the United States. (69%). For reference, 37.2% of New York City’s population is foreign born and approximately 6 in 10 New Yorkers are either immigrants or the children of immigrants.\textsuperscript{259,260} The mean age of sexual debut was 17.1 years (SD 2.8) matching the national average.\textsuperscript{261} Nearly 90% of participants reported condomless sex during their lifetime.

In this pilot study, we identified domains that may be slightly independent and should be explored in future research. There were no differences by study arm detected regarding knowledge or connection to clinical SRH services at follow-up. Knowledge levels were generally high at baseline. Despite a non-significant differential finding on knowledge, it was heartening that knowledge scores increased (out of a possible 15 points, the total sample score
was 9.67 at baseline) for 3 of the 4 knowledge sub-scales, albeit modestly: condoms, risk for HIV and other STDs, and STD/HIV rates among youth. Another possible explanation is that users simply were not accessing contents of the web-based application that highlighted this information (web-app usability is explored in Chapter 3). There was no change in knowledge on birth control pills. In addition, the magnitude of effect was in the positive direction for the condoms and for the STD/HIV rates among youth knowledge sub-scales to indicate that a larger sample size may further elucidate if either of these outcomes would be statistically significant.228,229

**Limitations**

Factor analysis showed that a small proportion of the variance was explained by the knowledge items asked. In addition, with the series of items regarding STDs with responses including strongly agree, somewhat agree, somewhat disagree, and strongly disagree, and not sure), we realized that these were attitudinal items. In the future, the lesson learned is to draw upon different knowledge scales or to ask these questions differently. Given the limited number of mHealth studies targeting young adult Black and Latina women, a future study should pilot knowledge scales with a small sample prior to launching a full RCT and emphasize newer primary and secondary prevention technology, (i.e., pre-exposure prophylaxis [PrEP] and post-exposure prophylaxis [PEP]). In addition, mHealth researchers should consider how to leverage technology for future work. For example, it would be interesting to include a gamification element (such as adding a quiz that becomes increasingly more challenging based on a user’s initial score and awards different “stickers” based on performance) to record users’ knowledge over time (throughout the study period), so that users could see how they perform over time, both as individuals and in comparison to other users.
As with other mHealth sexual and reproductive health interventions, we were underpowered to detect behavior change. In addition, the small sample size is susceptible to bias and this study was not powered to detect efficacy. For example, 4 times more respondents in the intervention arm reported using a text or chat button to connect to a clinic or provider, but the sample was too small to detect a statistical difference. This dissertation has established baseline data needed as a prerequisite to estimating effective sizes for future full-scale research for knowledge and connection to clinical services outcomes. In addition, this work will provide a better sense of what the baseline (control group) proportion is for this specific subpopulation, young Black and Latina women aged 18 to 25. Although appropriate for a pilot study to have only 1 follow-up assessment, a large-scale efficacy evaluation should additionally include a 6- and 12-month post-intervention to assess knowledge retention, and possibly include biological assessment of HIV/STD/pregnancy status alongside self-report measures, consistent with previous studies targeting young women of color.

CONCLUSIONS

Findings from this pilot trial of the GURHL Code intervention demonstrate the feasibility of retention and randomization process. A full scale randomized controlled trial is needed to further elucidate the impact of a tailored SRH web-app to explore knowledge retention over time, and to better understand the connection to clinical services via a SRH web-based app. Although there were no positive results regarding knowledge and connection to clinical services outcomes, a larger scale study with a modified version of the GURHL Code web-app would offer a better understanding of the impacts of a sexual and reproductive health web-app tailored for Black and Latina women aged 18 to 25 in an urban area, and thereby fill an important gap in the literature.
Figure 1. Knowledge mean sub-scale scores at baseline and post-test by study arm, non-significant findings

### Overall Knowledge Differences, Range 3 to 15

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3-months post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>9,98</td>
<td>9,86</td>
</tr>
<tr>
<td>Control</td>
<td>9,65</td>
<td>9,69</td>
</tr>
</tbody>
</table>

### Condoms Knowledge, Range 0 to 2

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3-months post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>0,95</td>
<td>1</td>
</tr>
<tr>
<td>Control</td>
<td>0,91</td>
<td>0,95</td>
</tr>
</tbody>
</table>

### Birth Control Pills Knowledge, Range 0 to 3

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3-months post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>2,27</td>
<td>2,25</td>
</tr>
<tr>
<td>Control</td>
<td>2,19</td>
<td>2,21</td>
</tr>
</tbody>
</table>

### STD/HIV Risk Knowledge, Range 0 to 8

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3-months post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>6,04</td>
<td>5,99</td>
</tr>
<tr>
<td>Control</td>
<td>5,74</td>
<td></td>
</tr>
</tbody>
</table>

### STD/HIV Rates Knowledge among Youth, 0 to 2

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3-months post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>0,69</td>
<td>0,63</td>
</tr>
<tr>
<td>Control</td>
<td>0,54</td>
<td>0,67</td>
</tr>
</tbody>
</table>
Table 1. GURHL (Guide to Understanding Reproductive Health for Ladeez) Code Content

<table>
<thead>
<tr>
<th>Code Content</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinic Finder and Trusted Resources</td>
<td>An option to search for nearby clinics using a database maintained by Bedsider (National Campaign to Prevent Teen Pregnancy) for a list of health centers and birth control providers. Information includes hyperlinks and clickable information that can then be opened using other web-apps and websites such as telephone numbers, and geo-location maps.</td>
</tr>
<tr>
<td>Things for the Clinic Visit</td>
<td>A simple list of items needed for a clinic visit, including items one may need if asking for financial assistance.</td>
</tr>
<tr>
<td>Text an Expert</td>
<td>An option for a participant to connect to a National Planned Parenthood health educator.</td>
</tr>
<tr>
<td>It Happened to Me</td>
<td>Two audio stories by a woman and a man about how they contracted HIV as young adults and are living with HIV in NYC.</td>
</tr>
<tr>
<td>STDs—Let’s Get Real</td>
<td>Clear and medically accurate information on STDs.</td>
</tr>
<tr>
<td>Questions, Honest Answers</td>
<td>Questions and answers created by Ibis Reproductive Health in order to assist health care personnel to respond to young women’s concerns around sexuality and sexual health.</td>
</tr>
<tr>
<td>Condoms</td>
<td>An educational website that provides information on how to properly put on a condom which includes both text descriptions and pictures of male and female condoms. It also directs users to where they can find free condoms in NYC.</td>
</tr>
<tr>
<td>My Parts</td>
<td>A basic educational video on reproductive female and male anatomy.</td>
</tr>
<tr>
<td>Who the heck made this app?</td>
<td>A brief description of how the web-app was made and by whom.</td>
</tr>
<tr>
<td>Did you know?</td>
<td>Rotating factoids on STDs and self-empowerment quotes and messages at the top of each page.</td>
</tr>
</tbody>
</table>
Table 2. Demographic and Sexual Behavior Characteristics of Final Sample (N = 105)

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Intervention</th>
<th>Control</th>
<th>Test Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>N=105</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latinas (including Black-Latinas)</td>
<td>63</td>
<td>60.0%</td>
<td>34</td>
<td>59.7%</td>
</tr>
<tr>
<td>Black</td>
<td>42</td>
<td>40.0%</td>
<td>23</td>
<td>40.4%</td>
</tr>
<tr>
<td>Married or partnered</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>40</td>
<td>38.1%</td>
<td>20</td>
<td>35.1%</td>
</tr>
<tr>
<td>No</td>
<td>65</td>
<td>61.9%</td>
<td>37</td>
<td>64.9%</td>
</tr>
<tr>
<td>College enrolled</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrolled</td>
<td>90</td>
<td>85.7%</td>
<td>47</td>
<td>82.5%</td>
</tr>
<tr>
<td>Not enrolled</td>
<td>15</td>
<td>14.3%</td>
<td>10</td>
<td>17.5%</td>
</tr>
<tr>
<td>Personal Income</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>up to $10,000</td>
<td>63</td>
<td>60.0%</td>
<td>33</td>
<td>58.9%</td>
</tr>
<tr>
<td>&gt; $10,000</td>
<td>41</td>
<td>39.1%</td>
<td>23</td>
<td>41.1%</td>
</tr>
<tr>
<td>Family Wealth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>bottom half</td>
<td>62</td>
<td>59.1%</td>
<td>35</td>
<td>61.4%</td>
</tr>
<tr>
<td>top half</td>
<td>43</td>
<td>41.0%</td>
<td>22</td>
<td>38.6%</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time (35 hours/week or more)</td>
<td>20</td>
<td>19.1%</td>
<td>12</td>
<td>21.1%</td>
</tr>
<tr>
<td>Part-time</td>
<td>51</td>
<td>48.6%</td>
<td>45</td>
<td>79.0%</td>
</tr>
<tr>
<td>Looking for work or unemployed</td>
<td>17</td>
<td>16.2%</td>
<td>7</td>
<td>12.3%</td>
</tr>
<tr>
<td>Student</td>
<td>84</td>
<td>80.0%</td>
<td>43</td>
<td>75.4%</td>
</tr>
<tr>
<td>Caregiver</td>
<td>21</td>
<td>20.0%</td>
<td>14</td>
<td>24.6%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to some college</td>
<td>56</td>
<td>53.3%</td>
<td>33</td>
<td>57.9%</td>
</tr>
<tr>
<td>College degree to Master’s degree</td>
<td>49</td>
<td>46.7%</td>
<td>24</td>
<td>42.1%</td>
</tr>
<tr>
<td>US-Born</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>77</td>
<td>73.3%</td>
<td>40</td>
<td>70.2%</td>
</tr>
<tr>
<td>No</td>
<td>28</td>
<td>26.7%</td>
<td>17</td>
<td>29.8%</td>
</tr>
</tbody>
</table>
Table 2. Demographic and Sexual Behavior Characteristics of Final Sample Continued

<table>
<thead>
<tr>
<th><strong>Parents country of origin</strong></th>
<th></th>
<th>( \chi^2 = 2.73 ) (1)</th>
<th>( p = 0.10 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 1 parent US born</td>
<td>33</td>
<td>31.4%</td>
<td>14</td>
</tr>
<tr>
<td>Neither parent US born</td>
<td>72</td>
<td>68.6%</td>
<td>43</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Parents College</strong></th>
<th></th>
<th>( \chi^2 = 2.02 ) (2)</th>
<th>( p = 0.13 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both went to college</td>
<td>29</td>
<td>27.6%</td>
<td>14</td>
</tr>
<tr>
<td>One parent/person who raised went to college</td>
<td>27</td>
<td>25.7%</td>
<td>19</td>
</tr>
<tr>
<td>Neither went to college</td>
<td>48</td>
<td>45.7%</td>
<td>23</td>
</tr>
<tr>
<td>Missing*</td>
<td>1</td>
<td>1.0%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Health Insurance</strong></th>
<th></th>
<th>( \chi^2 = 0.42 ) (2)</th>
<th>( p = 0.81 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>4</td>
<td>3.8%</td>
<td>2</td>
</tr>
<tr>
<td>Private Insurance</td>
<td>67</td>
<td>63.8%</td>
<td>35</td>
</tr>
<tr>
<td>Public Insurance (i.e., Medicaid)</td>
<td>34</td>
<td>32.4%</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Last sex act (select all that apply)</strong></th>
<th></th>
<th>( \chi^2 = 1.19 )</th>
<th>( p = 0.27 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaginal sex</td>
<td>104</td>
<td>99.1%</td>
<td>57</td>
</tr>
<tr>
<td>Anal sex</td>
<td>13</td>
<td>12.4%</td>
<td>8</td>
</tr>
<tr>
<td>Oral sex</td>
<td>73</td>
<td>69.5%</td>
<td>39</td>
</tr>
<tr>
<td>Played with sex toys</td>
<td>17</td>
<td>16.2%</td>
<td>9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Condomless sex in lifetime</strong></th>
<th></th>
<th>( \chi^2 = 0.01 )</th>
<th>( p = 0.90 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>94</td>
<td>89.5%</td>
<td>50</td>
</tr>
<tr>
<td>No</td>
<td>11</td>
<td>10.5%</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Number of sex partners</strong></th>
<th></th>
<th>( \chi^2 = 0.07 ) (2)</th>
<th>( p = 0.97 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 2 partners</td>
<td>40</td>
<td>38.1%</td>
<td>22</td>
</tr>
<tr>
<td>3 to 5 partners</td>
<td>27</td>
<td>25.7%</td>
<td>15</td>
</tr>
<tr>
<td>6 or more partners</td>
<td>37</td>
<td>36.2%</td>
<td>20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Number of standard drinks on a typical day</strong></th>
<th></th>
<th>( \chi^2 = 2.25 ) (2)</th>
<th>( p = 0.33 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 2 drinks</td>
<td>56</td>
<td>53.3%</td>
<td>15</td>
</tr>
<tr>
<td>3 or 4 drinks</td>
<td>30</td>
<td>28.6%</td>
<td>12</td>
</tr>
<tr>
<td>5 to 9 drinks</td>
<td>17</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>missing*</td>
<td>2</td>
<td>1.9%</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Drug use before last sex act</strong></th>
<th></th>
<th>Fisher’s</th>
<th>( p = 0.24 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>10</td>
<td>9.5%</td>
<td>6</td>
</tr>
<tr>
<td>no</td>
<td>95</td>
<td>90.5%</td>
<td>51</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Buzzed or drunk at last sex</strong></th>
<th></th>
<th>( \chi^2 = 0.17 ) (1)</th>
<th>( p = 0.69 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>17</td>
<td>16.2%</td>
<td>10</td>
</tr>
<tr>
<td>no</td>
<td>88</td>
<td>83.8%</td>
<td>47</td>
</tr>
</tbody>
</table>
### Table 2. Demographic and Sexual Behavior Characteristics of Final Sample Continued

<table>
<thead>
<tr>
<th>CONTINUOUS</th>
<th>Mean  (n=105)</th>
<th>SD</th>
<th>Mean  (n=57)</th>
<th>SD</th>
<th>Mean  (n=48)</th>
<th>SD</th>
<th>t-test</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean</td>
<td>22.1</td>
<td>2.1</td>
<td>22.1</td>
<td>2.2</td>
<td>22.1</td>
<td>2.0</td>
<td>0.05</td>
<td>p = 0.96</td>
</tr>
<tr>
<td>Mean age of first sex</td>
<td>17.1</td>
<td>2.8</td>
<td>16.9</td>
<td>2.8</td>
<td>17.2</td>
<td>2.7</td>
<td>-0.52</td>
<td>p = 0.60</td>
</tr>
</tbody>
</table>

*Missing values were excluded from significance testing.*
Table 3. Understanding of Applications Other than GURHL Code

<table>
<thead>
<tr>
<th>Do you ever have problems understanding the health information you find on apps?</th>
<th>Total</th>
<th>Intervention</th>
<th>Control</th>
<th>Test Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 105</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>No difficulty</td>
<td>5</td>
<td>5.0%</td>
<td>3</td>
<td>5.6%</td>
<td>2</td>
</tr>
<tr>
<td>Some level of difficulty</td>
<td>96</td>
<td>95.0%</td>
<td>51</td>
<td>94.4%</td>
<td>45</td>
</tr>
<tr>
<td>Missing*</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you feel that the health information you find on those apps is helpful to you?</th>
<th>Total</th>
<th>Intervention</th>
<th>Control</th>
<th>Test Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 105</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Helpful</td>
<td>25</td>
<td>25.0%</td>
<td>15</td>
<td>27.8%</td>
<td>10</td>
</tr>
<tr>
<td>Not helpful</td>
<td>75</td>
<td>75.0%</td>
<td>39</td>
<td>72.2%</td>
<td>36</td>
</tr>
<tr>
<td>Missing*</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Do you use apps to search for sexual health information? Choose all that apply.</th>
<th>Total</th>
<th>Intervention</th>
<th>Control</th>
<th>Test Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 105</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Things related to your period</td>
<td>81</td>
<td>77.1%</td>
<td>44</td>
<td>77.2%</td>
<td>37</td>
</tr>
<tr>
<td>General info on sexual anatomy</td>
<td>24</td>
<td>22.9%</td>
<td>13</td>
<td>22.8%</td>
<td>11</td>
</tr>
<tr>
<td>Signs or STD symptoms you may be experiencing</td>
<td>28</td>
<td>26.7%</td>
<td>14</td>
<td>24.6%</td>
<td>14</td>
</tr>
<tr>
<td>STD signs or symptoms a friend or family member may be experiencing</td>
<td>77</td>
<td>73.3%</td>
<td>43</td>
<td>75.4%</td>
<td>34</td>
</tr>
<tr>
<td>Pregnancy signs or symptoms you may be experiencing</td>
<td>34</td>
<td>32.4%</td>
<td>19</td>
<td>33.3%</td>
<td>15</td>
</tr>
<tr>
<td>Finding a doctor</td>
<td>71</td>
<td>67.6%</td>
<td>38</td>
<td>66.7%</td>
<td>33</td>
</tr>
<tr>
<td>Yes</td>
<td>26</td>
<td>24.8%</td>
<td>14</td>
<td>24.6%</td>
<td>12</td>
</tr>
<tr>
<td>No</td>
<td>79</td>
<td>75.2%</td>
<td>43</td>
<td>75.4%</td>
<td>36</td>
</tr>
</tbody>
</table>

*Missing values were excluded from significance testing.
## Table 4. Self-Report Linkages to SRH Services

<table>
<thead>
<tr>
<th>N=105</th>
<th>Total Sample</th>
<th>Intervention</th>
<th>Control</th>
<th>Test</th>
<th>Statistic</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Services needed in last 3 months. Check all that apply.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STD symptoms or testing</td>
<td>17</td>
<td>10.2%</td>
<td>10</td>
<td>17.5%</td>
<td>7</td>
<td>14.6%</td>
</tr>
<tr>
<td>Pregnancy testing</td>
<td>25</td>
<td>15.0%</td>
<td>16</td>
<td>28.1%</td>
<td>9</td>
<td>18.8%</td>
</tr>
<tr>
<td>HIV testing</td>
<td>8</td>
<td>4.8%</td>
<td>4</td>
<td>7.0%</td>
<td>4</td>
<td>7.0%</td>
</tr>
<tr>
<td>Emergency contraception</td>
<td>12</td>
<td>7.2%</td>
<td>9</td>
<td>15.8%</td>
<td>3</td>
<td>6.3%</td>
</tr>
<tr>
<td>Birth Control</td>
<td>43</td>
<td>25.8%</td>
<td>21</td>
<td>36.8%</td>
<td>22</td>
<td>45.8%</td>
</tr>
<tr>
<td>Abortion</td>
<td>2</td>
<td>1.2%</td>
<td>2</td>
<td>3.5%</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Pregnancy planning or fertility issues</td>
<td>7</td>
<td>4.2%</td>
<td>4</td>
<td>7.0%</td>
<td>3</td>
<td>6.3%</td>
</tr>
<tr>
<td>Advice about sex</td>
<td>17</td>
<td>10.2%</td>
<td>7</td>
<td>12.3%</td>
<td>10</td>
<td>20.8%</td>
</tr>
<tr>
<td>Did not need help or services in last 3 months</td>
<td>36</td>
<td>21.6%</td>
<td>18</td>
<td>31.6%</td>
<td>18</td>
<td>37.5%</td>
</tr>
</tbody>
</table>

**valid n = 69**

### Was able to get services for reasons indicated above in last 3 months. Check all that apply.

| I was not able to get services | 14 | 16.1% | 7 | 12.3% | 7 | 14.6% | 0.12 | p = 0.73 |
| Spoke with a clinic, doctor, nurse or other health care provider | 29 | 33.3% | 18 | 31.6% | 11 | 22.9% | 0.97 | p = 0.32 |
| Made an appointment and was seen by a health care provider | 51 | 58.6% | 28 | 49.1% | 23 | 47.9% | 0.02 | p = 0.90 |
| Used a text or chat button to connect to a clinic, doctor, nurse or other health care provider | 5 | 5.8% | 4 | 7.0% | 1 | 2.1% | | |
| Used an app to locate a clinic, doctor, or other health care provider | 10 | 11.5% | 4 | 7.0% | 6 | 12.5% | | |
Table 5. Sexual health knowledge change scores analysis at pre-post-test by study arm

<table>
<thead>
<tr>
<th></th>
<th>Baseline Mean</th>
<th></th>
<th>Post-test Mean</th>
<th></th>
<th>t-test</th>
<th>p - value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range</td>
<td>Intervention</td>
<td>Control</td>
<td>Intervention</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>Overall Knowledge</td>
<td>3 to 15</td>
<td>9.65 (2.41)</td>
<td>9.69 (2.63)</td>
<td>9.86 (2.20)</td>
<td>9.98 (2.22)</td>
<td>0.22</td>
</tr>
<tr>
<td>Condoms Knowledge</td>
<td>0 to 2</td>
<td>0.91 (0.82)</td>
<td>0.95 (0.87)</td>
<td>1 (0.82)</td>
<td>1.06 (0.91)</td>
<td>0.10</td>
</tr>
<tr>
<td>Birth Control Pills</td>
<td>0 to 3</td>
<td>2.19 (0.88)</td>
<td>2.27 (0.84)</td>
<td>2.21 (0.75)</td>
<td>2.25 (0.76)</td>
<td>-0.65</td>
</tr>
<tr>
<td>Risk for HIV and Other STDs Knowledge</td>
<td>0 to 8</td>
<td>5.95 (1.59)</td>
<td>5.74 (1.58)</td>
<td>5.99 (1.66)</td>
<td>6.04 (1.65)</td>
<td>0.95</td>
</tr>
<tr>
<td>STD/HIV rates among youth Knowledge</td>
<td>0 to 2</td>
<td>0.54 (0.53)</td>
<td>0.69 (0.66)</td>
<td>0.67 (0.63)</td>
<td>0.63 (0.61)</td>
<td>-1.23</td>
</tr>
</tbody>
</table>
CHAPTER 5—Conclusion

OVERVIEW

This pilot, a randomized 2-group sexual and reproductive mobile health (mHealth) study, aimed to expand the limited knowledge around the recruitment strategy, enrollment outcomes, feasibility, acceptability, and preliminary efficacy of a sexual and reproductive health web-based application (web-app) tailored with and for Black and Latina New York City-based women aged 18 to 25. A Community Advisory Committee (CAC) was engaged throughout the development process. For example, the name of the app, GURHL (Guide to Understanding Reproductive Health for Ladies) Code, was a play on the popular MTV show\textsuperscript{138} that the CAC helped identify to have a youthful tone and to attract participants to the study. The intervention group received the full version of the GURHL Code web-app, which included 10 sections: Clinic Finder and Trusted Resources; Things for the Clinic Visit; Text an Expert (at Planned Parenthood Federation of America); It Happened to Me (2 stories of how 2 individuals became HIV infected on audio); STDs—Let’s Get Real; Questions, Honest Answers (on sexual and reproductive health); Condoms (a visual depiction of how to put on male and female condoms); My Parts (videos on reproductive female and male anatomy); Who the heck made this app?; and Did You Know? appeared on each page, which included a rotation of STD factoids and self-empowerment quotes. The control group received standard-of-care, a single-page web-app that was effectively a flier on the web with a list of websites, and local clinics with telephone numbers and addresses.

First, the study compared efforts to recruit and enroll young Black and Latina women in New York City into a pilot randomized controlled trial (RCT) using online banner advertisements and targeted electronic outreach (i.e., emails to college professors and LISTSERVs). The study then examined the feasibility and acceptability of the GURHL Code web-app by triangulating focus
group results with web analytics and baseline and 3-month post-test survey results. Finally, the study explored preliminary efficacy of the web-app to impact sexual health knowledge (condom efficacy, birth control pills at preventing pregnancy and STDs, risk for HIV and other STDs, and STD/HIV rates among young people) and connection to clinical services (including Planned Parenthood Chat and directions to nearby clinics). The 3 aims of the study fit within the conceptual framework of the social cognitive theory (SCT) as well as design thinking. The SCT framework considers the interconnection of individual and environmental factors. Digital constructs of user-centered design and user experience culminate in design thinking to promise not simply appealing aesthetics and utility, but a deep understanding of human experience to then develop a product, service, or process that improves that area of experience for many, empowering people in new ways. The main findings and interpretations are summarized below.

**AIM 1—KEY FINDINGS**

Although there is a growing trend in using online recruitment approaches for mHealth studies, and this has become an established successful recruitment source among some populations such as men who have sex with men, there is limited research in utilizing online banner advertisements specifically to recruit young adult Black and Latina women into mHealth studies. Analyses comparing efforts to recruit and enroll young adult Black and Latina women into a pilot RCT using online banner advertisements and targeted electronic outreach (i.e., emails to college professors and LISTSERVs) highlighted stark differences in successful recruitment sources for this mHealth study. The GURHL Code study additionally evaluated recruitment approaches using cost and web analytics metrics, including the amount of money spent per enrolled participant, which included purchased online advertisements and staff hours spent on
recruitment, but excluded participant incentives. This study found that recruiting through emails to college professors and college LISTSERVs was more effective was recruiting with Facebook banner advertisements. We suggest that more research is needed to better understand whether recruiting young women of color might be facilitated through known and trusted adults, such as professors who are connected to these young women, rather than through an anonymous banner ad on social media.

Analyses compared the cost in dollars spent per participant enrolled by recruitment sources and the number of impressions needed to yield an enrolled participant. A total of $704.75 was spent on Facebook ads, which translated into necessitating 137,666 impressions to generate a single participant, at a cost of $352 per participant. By comparison, a total of $287 was spent on OkCupid banner ads, generating 143,515 impressions, but no completed screening surveys; thus, no participants were enrolled via OkCupid. Then we compared Facebook to targeted electronic approaches (i.e., emails to college professors and LISTSERVs), recruitment sources that generated enrolled participants. Participants recruited via targeted electronic sources were more likely to complete the survey after starting, be eligible, and, among those eligible, were more likely to enroll than were those recruited via Facebook. Targeted electronic recruitment was more cost-effective than recruiting via Facebook ($1.59 was spent per enrolled participants versus $273.50 via Facebook). Examining cost by screening surveys started, completed, and cost per eligible and enrolled participant was also more cost effective by targeted electronic source compared to Facebook.

Three banner ads were purchased: 1) one depicted only the study logo, 2) one included an image of a Black woman with the study logo, and 3) one depicted a Latina woman with the study logo. Another important finding indicated that potential enrollees responded more positively
(yielded a higher click-through rate) to the banner ads with women and the logo compared to the logo-only banner ads. The study found the banner ads including an image of a Black young adult woman had the highest click-through-rate and the most effective costs-per-link at $0.24 for the logo only banner ad; $0.17 for the banner ad including a Latina woman, and $0.16 for the banner including a Black woman. Future researchers and health providers should consider banner ads that include both a study logo and images reflecting the population of interest. That said, the conversion rate was good in comparison to other health research click-through rates, thus, a future approach might be to expand recruitment efforts via banner ads for a period beyond 2.5 months.

This study additionally examined demographic and behavioral characteristics of those who were eligible and enrolled into the GURHL Code study compared to those who were eligible and began the screening survey but did not enroll in the study. The study found those enrolled in the study were more likely to report an income below $20,000, to be working part-time, or to be a student compared to those who did not enroll. No participant reported an income above $50,000 or more, either among those enrolled or those not enrolled in the study. We attribute these findings to the incentives used for the study, which may appeal more to those with low incomes.

AIM 2—KEY FINDINGS

The second aim of this study was to explore the feasibility and acceptability of the control and the intervention web-apps. Triangulating focus groups, survey responses, and Google Analytics results suggested that participants were enthusiastic about several aspects regarding the availability of the intervention web-app of GURHL Code in comparison to the standard of care control “flier on the web” website. Focus group participants reacted positively to the colors, the
direct language, and transparency about the web-app developer. Participants responded enthusiastically to the simple yet clear language and images of the step-by-step condom instructions and the Questions, Honest Answers sections. Web analytics behavior path data demonstrated higher utilization of the anatomy screen, however, during focus groups, the Planned Parenthood chat function and the Questions, Honest Answers screens were mentioned with stronger emotional intensity.

Although focus group participants reported that they might not have a reason to visit the web-app daily, they were interested in both sharing and keeping GURHL Code, particularly with women they knew with ties to or who might be connected to “sexually less experienced” women, including younger sisters and cousins, and mothers of adolescent or young adult women. This was driven, at least in part, by the misinformation imparted by focus group participants’ family members around sexual and reproductive health and sexuality. Focus group participants were interested in keeping GURHL Code on their phones to refresh their own sexual health knowledge, and for what they referred to as “oops” moments (e.g., after a condomless sex act for themselves or a friend, after receiving an STD diagnosis, or to find and connect to a provider).

This study found that using a smartphone for sexual and reproductive health education was also desirable and feasible, particularly to connect to a Planned Parenthood health educator via the text feature and that it aided focus group participants in their ability to find a clinic in New York City. One focus group participant shared how she received a herpes diagnosis while enrolled in the study and spoke about using the GURHL Code intervention web-app to learn more about her specific diagnosis and about STDs in general. The participant also used the Planned Parenthood chat function to “put her mind at ease” about her herpes 2 diagnosis, and explored the Who the heck made this app? section of the web-app. She shared that she
appreciated the transparency regarding the motivation for making the web-app and that the developer and PI was a highly educated woman. This finding was consistent with the literature regarding mobile health web-apps serving as an effective tool to manage and cope with difficult situations when other support options are unavailable. That the space created on GURHL Code was “for women only” was well received by participants; this was another finding consistent with the literature. Goldenberg and colleagues also found that the MSM who participated in their formative focus groups also responded well to the safe space that a tailored web-app could provide if they trusted the app and the app’s creator.

Participants from both treatment conditions found both web-apps easy to use, well organized, and, additionally, found the GURHL Code intervention web-app to be trustworthy and useful. Despite these positive results, web analytics results show low user engagement, which is consistent with users reporting that they would want to have access to GURHL Code for “oops” moments. Time engagement analytics might be improved by adding some of the content and features that participants mentioned. For example, focus group participants suggested the following expanded content included understanding the steps of an abortion, the steps to follow when reporting sexual assault, healthy relationship and health-specific information for sexual minority women, including trans-women. Additional features might include gamification elements such as interactive quizzes, and period or condom trackers. Dislikes mentioned in the focus groups were most commonly associated with technical issues, and participants shared that, for this pilot, they found the web-app acceptable, but that for a future larger scale study or release, they would expect to find the web-app in the marketplace such as Apple’s App Store or Google Play.

AIM 3—KEY FINDINGS
The third aim of this study was to explore the preliminary efficacy in the treatment versus control arm over 3 months to increase sexual health knowledge, intention to connect to sexual and reproductive health clinical services, and self-report linkages to SRH services. The GURHL Code study had a 92% retention rate (completing baseline enrollment and 3-month follow-up assessment) and provided preliminary support for the feasibility of a web-based app for STD/HIV prevention intervention. The study found that the intervention and control groups were comparable on demographics, sexual history, and other risk behaviors, as well as regarding the understandability of other web-based health applications, an indication of successful randomization. Of note, when asked about their experience in seeking health information on other applications aside from GURHL Code, a large proportion of the sample reported some level of difficulty in understanding health information found on apps other than those used in this study and that they were unhelpful. In addition, women reported searching for SRH information on things related to their period, pregnancy signs or symptoms they may be experiencing, sexual anatomy, finding a doctor, or signs and symptoms of STDs they may be experiencing. Less so, they also reported searching for signs and symptoms of STDs that a friend or family member may be experiencing.

Participants from both treatment conditions reported needing sexual and reproductive health services for birth control most often, advice and information about pregnancy and STD testing, and, to a lesser extent, emergency contraception, HIV testing, pregnancy planning or fertility issues, and abortion. To address their health needs, women in this study reported that they made an appointment and were seen by a health care provider or spoke with a health care provider. A small proportion of participants reported using a text or chat button to connect to a provider or using the web-app to locate a clinic or provider.
In this pilot study, we identified domains that may be independent and should be explored in future research. These domains were: a condom knowledge sub-scale; risk for HIV and other STDs knowledge sub-scale; STD/HIV rates among youth knowledge sub-scale; and a birth control pills knowledge sub-scale. Baseline analysis of knowledge items suggested successful randomization, as there was no significant difference on mean knowledge scores at baseline. There was also a non-differential finding on knowledge sub-scales at post-test, which may be attributable to high knowledge baseline scores. Specifically, despite a non-significant differential finding on knowledge, it was heartening that knowledge scores increased (out of a possible 15 points, the total sample score was 9.67 at baseline) for 3 of the 4 knowledge sub-scales, albeit modestly: condoms, risk for HIV and other STDs, and STD/HIV rates among youth. In addition, the magnitude of effect was in the positive direction for the condoms and for the STD/HIV rates among youth knowledge sub-scales to indicate that a larger sample size may further elucidate if either of these outcomes would be statistically significant. Another possible explanation is that users were not accessing contents of the intervention web-based application that highlighted this information.

LIMITATIONS

There are several limitations to this study. First, limited resources to carry out this dissertation delayed the development of the project initially due to high developer consultant turnover. To address this, both the intervention and control web-based applications were developed by the PI on a WordPress platform using HTML, CSS, PHP, and Javascript. Limited funding also impacted the ability to recruit via banner advertisements for extended periods or heavily during a short period. A future study should budget appropriately to cover these costs. Second, the majority of the GURHL Code study sample was recruited within the CUNY system,
which may impact external validity; however, CUNY is a sub-population reflective of New York City with 84% of its total population reporting a high school background from within NYC.\textsuperscript{176,182}

It is unknown whether the GURHL Code study participants’ level of education is a protective factor for sexual health behavior given the sample size and limited power in this pilot study.

Related, there was the potential for contamination if an enrolled student participant did not report the name of the professor who directed them to the study. Participants were assigned to the same treatment group based on the initial person who identified the referring professor. During focus groups, participants revealed that they shared the web-app they were assigned, so there was the possibility of contamination. One participant was recorded as viewing both web-apps from the same IP address, indicating very low contamination from a single IP address. Third, as with other mHealth pilot studies, we were underpowered to detect behavior change.\textsuperscript{162,232,251–253} For example, 4 times more intervention arm participants reported using a text or chat button to connect to a clinic or provider, but the sample was too small to detect a statistical difference.

Similarly, there were several measures that were trending toward statistical significance (i.e., regarding ease of web-app use and condom knowledge, birth control pills knowledge, STD/HIV risk knowledge, and STD/HIV rates knowledge sub-scales) that a larger sample might be able to determine. Fourth, there are several measures that should be modified for a future study. For example, the recruitment source data was based on self-report data, and susceptible to recall bias and high missingness. Thus, we recommend that a future study generate multiple surveys to run analyses by recruitment source. Similarly, factor analysis revealed knowledge domains that may be independent and should be explored in future research. There were several technical challenges impacting intervention delivery, implementation, and ultimately, dosage and exposure to the intervention. For example, several focus group participants from both treatment conditions
reported removal of the web-apps from their home screens after their phones underwent software updates. There was a participant who reached out when she was unable to view the Text an Expert (Chat with a Planned Parenthood expert) and was then coached to hold her phone in the landscape position for the feature to work properly on her phone. We are unable to know how long this was an issue, or how many women in the study were impacted. These technical issues could have contributed to low user engagement and may offer an explanation as to why there was no observed difference regarding knowledge outcomes by treatment arms. Also, the analytic data should be interpreted with caution. Web analytics revealed visitors on both web-apps from countries outside of the United States. To address this, only analytic data generated from users in NYC who were female was analyzed. Gender is determined by Google drawing from information provided to a Google account, a Google partner, or is estimated based on a sub-sample of users through a combination of self-report data and Internet browsing data. We acknowledge that, by design, the intervention page had more content to view versus the control page and while the comparison yielded a statistically significant difference, findings should be interpreted cautiously.

This study could have been strengthened had the outcome choice focused on attitudinal change rather than behavior change, especially given the sample size. Future recruitment source comparisons will dedicate a specific survey to assess differences between participants and to evaluate the effectiveness of each recruitment source. The full version of the System Usability Scale\textsuperscript{220} should be used to assess both web-application’s usability. There was a concern about the survey being so long that participants would not complete it, however, the high retention rate suggests this assessment could have been included in its entirety. Finally, had the study design included weekly assessments, this could have provided an opportunity to capture more process
measures and ongoing feedback including capturing technical issues as they arose rather than learning about them in focus groups after the 3-month study period had ended. However, weekly assessments would have introduced bias by prompting participants to think about their behavior on a more regular basis.

**STRENGTHS AND PUBLIC HEALTH SIGNIFICANCE**

There are a number of strengths to this study. First, this was theory driven mHealth research, a deficit of 7 out of 10 trials recently included in a systematic review of RCTs of sexual health interventions delivered by mobile technologies. Several theories and constructs were driving this research. The social cognitive theory was used because it considers the environmental and individual factors involved in behavior change. In addition, given the use of technology for this pilot, the framework guiding this project draws from research and practical applications that demonstrate the potential of technology to increase access to knowledge and information and to promote learning. In addition, this project drew from a design thinking approach to understand users’ needs through multiple rounds of user testing by incorporating an active Community Advisory Committee for divergent view-points. Second, given the dearth of sexual and reproductive mHealth research, specifically for women of color, one of the main contributions to the field is that this work is narrowly focused on Black and Latina women aged 18 to 25 in an urban setting. There are a few other sexual and reproductive mHealth studies tailored for Black women, with a wider age range, and we found no mHealth SRH studies tailored for Latina women. This seems particularly odd given that Latinos tend to use their smartphones to search for health information on their mobile devices 3 times more often than Whites, and ethnic/racial disparities suggest a need among Latinas. Moreover, prior SRH mHealth research that has involved Black women did not take full advantage of the mobile
aspect of health-technology and has largely explored technology in a clinic setting. This study allows participants to access information at all times in the location of their choosing and adds to the limited knowledge on preferences for a SRH mobile app for young adult Black and Latina women in an urban environment. Finally, although baseline and post-test 3-month follow-up survey analysis by treatment group revealed no change in knowledge or connection to clinical care alone, another strength of this study was implementation of a mixed methods design. This intervention and study design are feasible and acceptable based on triangulating focus group, survey, and web analytics results, successfully recruiting Black and Latina women and a demonstrated high retention rate of participants from enrollment through the follow-up survey, 3 months later. In addition, participants were successfully randomized as evidenced by the lack of differences of demographic characteristics and sexual behaviors, and there is a remaining gap that exists to provide access to easy to understand and helpful information desired on an app in a “for women only” space. Moreover, the promise of health-tech interventions lie in their potential for intervention impact, defined as the product of efficacy times reach (% of population receiving).

**IMPLICATIONS FOR PROGRAMS AND RESEARCH**

Health-technology applications have morphed since the inception of the World Wide Web in 1994 when the primary purpose was to provide information, which was different from the second generation of the Web (Web 2.0) that focused on interconnectivity and participative web and social networks. Today, the phase of the Internet of Things (Web 3.0) has shifted yet again towards the interconnection of “smart objects” that exchange data with each other without the need for human intervention. Building usability and user-centered design familiarity is increasingly important as more public health researchers and practitioners execute interventions
with a technological component (i.e., web-apps, SMS, the Internet and games, wearables, and other tools not yet invented). As such, understanding the approaches to achieving high quality and effective user-centered design is critical as they affect funding, study design, and the need to potentially collaborate with developers. Usability testing is often akin to the iterative processes executed in community-based participatory public health research to meaningfully engage communities and to respond to community needs rather than to the researcher’s agendas. Usability testing development, similar to the refinement of qualitative and quantitative research methods, continues to evolve. It is appropriate to consider what methods best match the types of digital technology being used with the intended population.\textsuperscript{210,211,269}

Good usability and user-centered design offer lessons that are applicable for public health practice. At its core, these constructs prioritize the user. They ask: How will a potential user react and interact with the different pieces of the web or application? At its best, public health messages strive to do the same, rather than implement top-down messaging. From communicating about HIV and Ebola to crisis management during Superstorm Sandy, technology may offer useful frameworks to more effectively reach the public, and, in particular, those who are harder-to-reach, to protect health and to promote well-being.

Although we expected to recruit our sample capitalizing off the broad reach that social networks and online dating websites had to offer (specifically, on Facebook and OkCupid), we found that recruiting a sample of New York City–based Black and Latina women aged 18 to 25 was more easily achieved by recruiting through CUNY professors and campus listservs. We did not find it feasible to recruit a large sample of women in a short time frame (2.5 months) through banner ads on an online dating app; social network banner ads yielded somewhat more success, but a larger budget might help overcome this barrier to increase the daily banner
advertisement reach. A snowballing recruitment approach through a gatekeeper, and professors, yielded the best results. We urge those conducting longitudinal studies recruiting young adult Black and Latina women based in an urban city to consider a multitude of recruitment sources, especially if working with a limited budget and timeline.

Given the inclination of focus group participants to share GURHL Code with less sexually experienced women, there may be an opportunity to broaden prospective research to include a broader age range of women by creating a suite of native web-based applications (i.e., available on the marketplace via Apple’s App Store and Google Play) ranging from teenaged women to the parents and caregivers of young women. There is compelling evidence for adolescent sexual health needs: 18% of those younger than 15 years old have had sex, and 16,000 pregnancies occur annually in that age group; among those aged 15 to 17, 30% have had sex and 252,000 get pregnant. In addition, the literature suggests that technology can be especially effective through learning-by-doing approaches.

A web-based application for parents could offer SRH education and possibly language they might practice around sexuality and sexual and reproductive health they could use with their children for conversations known to be embarrassing for parents or for conversations they simply are unprepared to have. A tool to foster good communication and comfort between parents and adolescents around sexual issues, would be especially relevant given Diiorio and colleagues finding that if an adolescent talks more with their mother about sexual issues than with friends, they are less likely to initiate sexual intercourse and are more likely to have conservative values. Moreover, a suite of web-apps tailored for several groups would be appropriate given that prior research around participants’ receptiveness toward mHealth apps appeared to transcend age and educational level. Although the GURHL Code study did not find a significant
difference between treatment arms regarding knowledge or self-reported connection to care, there are positive mHealth interventions. For example, Milosevic, Shrove, and Jovani found wearable body sensors to positively affect behavior change when there was a monitoring component to the application. Given this finding, future work might consider how to incorporate monitoring or wellness management and tracking systems. For the proposed work above this might translate into allowing the user to monitor the number of conversations parents have with their children in the parent app and allow for note-taking to allow parents to reflect how the conversation went, and what they might do differently in a future conversation. For the applications for the young women, this might include period or condom trackers.

Baker, Gustafson, and Shah have identified efficiency and quality strategies for increasing the timeliness and usefulness of eHealth research. Drawing from the lessons learned from conducting this dissertation, and the strategies Baker et al., offer, my future mHealth research will apply the following to more definitively answer the question of efficacy: draw from small, focused, and efficient research, and applying efficient research designs. A small, focused, and efficient strategy refers to usability studies efficiently and effectively being executed with a small sample size to explore discrete questions about preferred content and design. This also refers to borrowing from AIDS research that focused on proximal outcome measures such as viral load, which is highly sensitive to treatment, that ultimately reduced reliance on distal clinical outcomes such as survival. mHealth researchers must explore those proximal outcomes that are clinically meaningful and highly sensitive and responsive to effect being evaluated such as self-efficacy, increased medication adherence, and greater perceived social support to impact continuous improvement. A stepped-wedge or quasi-experimental design allows the same total sample be exposed to control and intervention components and then measure whether
meaningful change has occurred upon such manipulations. Lastly, mHealth researchers could borrow from efficient engineering practices to continuously enhance interventions to incorporate clinical and technological progress. One concern with this strategy is that clinical effects might not be evaluated. Baker, Gustafson, and Shah argue that one strategy would be to longitudinally compare the intervention through its various improvements to the ever-changing Internet access serving as a control. Such intensive multi-phased longitudinal modeling allow for powerful and focused statistical analysis.

Finally, with a continued interest in technology for public health promotion, epidemiological tracking, and biomedical tracking, there may also be a tension between rigor of research design and the rapidity of human-centered and developed tools. Cross-sector collaborations are needed to advance the health-tech field, and public health researchers interested in drawing from interactive digital technology could benefit from learning the fundamentals of user-centered design and basic coding concepts to understand the capabilities and limitations of the technology. Given the range and volume of the potential of mobile health applications to serve public health, it is expected that the health-technology field will continue to grow, and, thus, a need for research to explore best practices for reaching a broad range of people on a wide range of public health issues will also grow. Researchers have struggled with translating mHealth and eHealth more broadly for wide usage (M. Ybarra, personal communication, June 15, 2017). Technology is not disseminated with a “build it and they will come” approach, perhaps another important collaboration for mobile health researchers and public health practitioners will be to form ties with those who understand e-marketing techniques for sub-populations of interest. Our health technology–focused work cannot end with recruitment
and the publication of our research endeavors, rather, dissemination of effective mHealth interventions is critical to improve the public’s health.
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