Prevention Science (2019) 20:68–77
https://doi.org/10.1007/s11121-018-0905-6

eHealth Familias Unidas: Efficacy Trial of an Evidence-Based Intervention Adapted for Use on the Internet with Hispanic Families

Yannine Estrada[1] · Tae Kyoung Lee[1] · Rachel Wagstaff[1] · Lourdes M. Rojas[1] · Maria I. Tapia[1] · Maria Rosa Velázquez[1] · Krystal Sardinas[1] · Hilda Pantin[1] · Madeline Y. Sutton[2] · Guillermo Prado[1]

Published online: 10 May 2018

Abstract

While substance use and sexual risk behaviors among Hispanic youth continue to be public health concerns, few evidence-based preventive interventions are developed for and implemented with Hispanic/Latino youth. The objective of this study was to evaluate the efficacy of *eHealth Familias Unidas*, an Internet adaptation of an evidence-based family intervention for Hispanics. A randomized controlled trial design ($n = 230$) was used to evaluate intervention effects on substance use and condomless sex among a sample of Hispanic eighth graders with behavioral problems. Participants were randomized to eHealth Familias Unidas ($n = 113$) or prevention as usual ($n = 117$) and assessed at baseline and 3 and 12 months post baseline. We trained mental health school personnel and community mental health professionals to recruit and deliver the Internet-based intervention with Hispanic families. It was hypothesized that, over time, eHealth Familias Unidas would be more efficacious than prevention as usual in reducing drug use (marijuana, cocaine, inhalants, and other drugs), prescription drug use, cigarette use, alcohol use, and condomless sex and that these changes would be mediated by family functioning. Significant intervention effects were found across time for drug use, prescription drug use, and cigarette use. While eHealth Familias Unidas positively affected family functioning, mediation effects were not found. This study demonstrated that family-based eHealth interventions can be efficacious among Hispanic populations when delivered in community settings.

Keywords Internet adaptation · Drug use prevention · Hispanic adolescents

Drug use and sexual risk behaviors—two of the leading causes of serious health problems—are preventable (Mokdad et al. 2004), but the critical need to address these behavioral concerns among Hispanic adolescents remains largely unresolved. Family-based preventive interventions demonstrate strong scientific evidence for averting adolescent risk behaviors such as drug use and sexual risk, but engagement, retention, and widespread availability of these interventions is a challenge (Ingoldsby 2010; National Research Council and Institute of Medicine [NRC&IM] 2009).

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s11121-018-0905-6) contains supplementary material, which is available to authorized users.

✉ Yannine Estrada
yestrada@med.miami.edu

[1] Department of Public Health Sciences, Miller School of Medicine, University of Miami, 1120 NW 14th Street, Miami, FL 33136, USA

[2] Division of HIV/AIDS Prevention, Centers for Disease Control and Prevention, Atlanta, GA, USA

While some face-to-face interventions that target drug use and sexual risk behaviors have been implemented, many require numerous resources including cost, personnel, time, space, and coordination (Aarons and Sawitzky 2006; Noar et al. 2009). This limits the ability to feasibly introduce these interventions to a large subset of the population (Bell et al. 2007; Noar et al. 2009). Participant level barriers also exist that prevent engagement and retention into evidence-based family preventive interventions, including scheduling, lack of transportation, and childcare (Mendez et al. 2009). Therefore, developing and testing interventions that ameliorate barriers and facilitate widespread dissemination in the community are important. Internet delivered, or eHealth, interventions may potentially mitigate some of the barriers and challenges hindering the delivery of evidenced-based interventions (Perrino et al. in press) and help narrow the wide health gaps that exist among minority populations (Hudnut-Beumler et al. 2016), including Hispanics.

Ethnic minorities are disproportionally more likely to engage in drug use and unsafe sex (Kann et al. 2016). Disproportionate health risk behaviors exist in Hispanic drug

use with Hispanic eighth graders reporting the highest lifetime and current prevalence of alcohol and illicit drug use, compared to their African-American and non-Hispanic White counterparts (Johnston et al. 2017). This is concerning, because during formative adolescence, regular drug use is likely to have negative cascading effects on familial and peer relationships, academic performance, and mental/emotional health (Ellickson et al. 2004), among other negative consequences. Disparities are also evident in sexual risk behaviors. In 2015, only 55.6% of the Hispanics reported using condoms during their most recent sexual intercourse, compared to 63.4% of African Americans and 56.8% of non-Hispanic whites (CDC 2017a). Concerning trends from the CDC also reveal that while annual HIV infections decreased from 2008 to 2014 among white gay and bisexual males, they have increased 20% among Hispanic gay and bisexual males (CDC 2017b); this fact highlights the need for continued intervention.

In light of the persistent health disparities that exist among Hispanic youth, it is vital for the well-being of Hispanic adolescents to reduce and/or prevent drug use and condomless sex through the evaluation and dissemination of preventive interventions. Further, given that, historically, interventions have been widely tested among Caucasians but not racial/ethnic minorities (Zayas et al. 2009), understanding whether interventions work for Hispanic populations is important. This is in line with *precision prevention* in which behavioral interventions are targeted towards not only individual characteristics, but also "precise" groups or entire communities by, for example, modifying delivery systems (Gillman and Hammond 2016). If the scientific community is to make advancements in precision prevention, understanding whether interventions are efficacious among Hispanic families, an underserved and large proportion of the US population (17%; U.S. Census Bureau 2015), should be a significant priority. Therefore, the purpose of this manuscript was to evaluate the efficacy of *eHealth Familias Unidas*, an Internet, eHealth adaptation of a family evidence-based intervention to prevent or reduce drug use and condomless sex.

The Internet and the widespread use of technology offer new opportunities for reaching populations that otherwise would not receive preventive interventions (Mohr et al. 2013) and for addressing barriers to dissemination and implementation (NRC&IM 2009). In 2013, the US Census Bureau reported that among households in the USA, 83.8% reported computer ownership and 74.4% reported Internet use (File and Ryan 2014). Further, statistics indicate that even minority and low-income groups have widespread access to the Internet (Knapp et al. 2011), making the promise of availability to preventive interventions viable for underserved groups. Because the vast majority of people in the USA own a computer, an auspicious new opportunity has presented itself. Internet delivered, or eHealth, preventive interventions are capable of counteracting the limitations of traditional face-to-face facilitated interventions by utilizing the convenience of a computer or tablet as the primary method of delivery (Noar et al. 2009). The benefits of eHealth interventions include minimal comparative cost, maintenance of fidelity through content standardization, opportunity for personalization, and participant convenience (Marsch et al. 2011; Noar et al. 2009).

The last decade has evinced an explosion of eHealth interventions. A review of the intervention literature identified 30 technology-based psychosocial interventions for children and families that were tested in a randomized controlled trial design (MacDonell and Prinz 2016). Some of the most recognized programs such as the *Incredible Years*, *Triple P*, *Strong African American Families* and *Parent Management Training* have all been adapted for technological use. Interventions have been developed for depression (Gladstone et al. 2015), substance use (Newton et al. 2014), and HIV prevention (Noar et al. 2009), among others. While technology-based preventive interventions hold the promise for reaching groups that would otherwise not participate in these programs, they are not without limitations and challenges.

Major limitations include the fact that while Internet accessibility is increasing across groups, it is not always consistently available to families (MacDonald and Prinz 2016). While researchers suggest the digital divide is narrowing (Nagler et al. 2013), individuals with greater education, income, and in urban settings are more likely to have access to faster Internet connections than less educated, poor, and rural groups (Nagler et al. 2013; Viswanath 2011). Additionally, some studies have reported low overall participation rates in eHealth interventions (Mohr et al. 2013). Further, there is a lack of science about the efficacy of these interventions among underserved populations such as Hispanics. Indeed, to our knowledge, there are no studies evaluating the efficacy of eHealth preventive interventions to prevent drug use and condomless sex among Hispanic youth. Also, eHealth interventions are usually psychoeducational and not family centered (Bennet and Glasgow 2009). Therefore, with the potential of the Internet as a viable medium for delivering preventive interventions, we developed eHealth Familias Unidas. To test the efficacy of eHealth Familias Unidas, we enrolled and randomized 230 Hispanic adolescents and their primary caregivers into eHealth Familias Unidas or prevention as usual. We hypothesized that eHealth Familias Unidas would be more efficacious than prevention as usual, across time, in preventing and/or reducing drug use (including marijuana, cocaine, inhalants, and other drugs), cigarette use, alcohol use, prescription drug use, and condomless sex. Additionally, we hypothesized that family functioning would partially mediate intervention effects on all main outcome variables across time (Figure S1 available online).

Background Overview of Familias Unidas

Familias Unidas is a rigorously tested family-based preventive intervention with evidence for reducing and/or preventing Hispanic adolescent behavioral problems in five completed and published randomized controlled trials (Estrada et al. 2017b; Pantin et al. 2003, 2009; Prado et al. 2007, 2012). In previous trials, family functioning was a mediating variable for intervention effects. Trained facilitators deliver the manualized intervention through eight parent-only group sessions (with 10–15 parents in a community setting) and four family sessions (with a parent and their adolescent in their homes or community setting).

Method

Study Design

To evaluate the efficacy of eHealth Familias Unidas delivered via the Internet, we utilized a randomized controlled efficacy trial. At baseline, eligible families (Fig. 1) were consented (parents) and assented (youth) and randomized to either eHealth Familias Unidas ($n = 113$) or prevention as usual ($n = 117$). Out of 454 families assessed for eligibility, 230 families enrolled and were randomized (i.e., 50%). The majority of families who did not participate ($n = 188$) were screened by phone but did not show up to the assessment appointment. Participant families ($n = 230$) were assessed at baseline and followed for 3 and 12 months post baseline.

Procedures

Participant recruitment, intervention delivery, and assessment follow-up ran from April 2014 to October 2016. Adolescents and their primary caregivers were recruited from 18 middle schools in the Miami-Dade County Public School (MDCPS) district with letters that were sent home with students and through referrals from school counselors. Study eligibility consisted of: (a) adolescents of Hispanic origin; (b) adolescents in the eighth grade at enrollment; (c) adolescents living with a primary caregiver who was willing to participate in the study; (d) families living within the catchment area of a MDCPS school at baseline; (e) access to the Internet (e.g., at home, school, or library); and (f) adolescents exhibiting a level I, II, or III behavior problem as defined by MDCPS. Level I behaviors included acts that disrupt the orderly operation of the classroom, school function, and extracurricular activities or approved transportation; level II behaviors are more serious and included destruction of property, or confrontation with school staff; and level III behaviors included harmful and/or offensive behaviors such as physically harming others or endangering safety.

Parent participants received a grocery store gift card valued at US$40 for the baseline assessment, US$80 for the 3-month, and US$85 for the 12-month post baseline assessment. Adolescents received a movie ticket for completing the assessment at each time point. Assessments were completed at the adolescents' school and were administered via the Audio Computer-Assisted Self-Interview (ACASI) software, a computerized program that has been shown to decrease biased responses to sensitive questions in previous studies involving youth (e.g., Metzger et al. 2000). ACASI programming included an audio option for participants with reading difficulty and was conducted in English or Spanish, depending on the participant's language preference. Assessments were conducted in separate rooms for parents and adolescents. An assessor remained in the room during the whole assessment process to monitor completion and troubleshoot any technical difficulties with the equipment.

Participants

The mean age for adolescents was 13.6 years ($SD = 0.7$). Adolescent males made up a slight majority of the sample (63%). For the most part, adolescents were born in the USA (56.5%). Adolescents born outside the USA were mainly from Cuba (20%), Honduras (6%), and Colombia (3%). The majority of yearly household incomes (55.7%) were below US$20,000.

Study Conditions

eHealth Familias Unidas The main differences between Familias Unidas and eHealth Familias Unidas is that instead of a group of parents meeting with a facilitator, parents logged on to the eHealth Familias Unidas website to access prerecorded e-parent group sessions, engaged in interactive exercises, and watched a soap opera series. Nonetheless, the core elements and number of sessions in both interventions is the same. Detailed information about the development of eHealth Familias Unidas has been previously published (Estrada et al. 2017a; Perrino et al. in press). As an overview, the intervention consisted of (1) eight online recorded, e-parent group sessions that were accessed via the Internet and (2) four parent-adolescent family sessions delivered by a facilitator via web-based video conferencing software. Families were given a login and password to access the intervention through a website specifically designed for the study. This site was also used to track whether participants were watching the sessions.

e-Parent Group Sessions We used the Familias Unidas manual to transpose the active components of the eight face-to-face group sessions into eight e-parent group video sessions lasting approximately 30 min. Parents were able to watch the e-parent group sessions at their convenience. The e-parent group

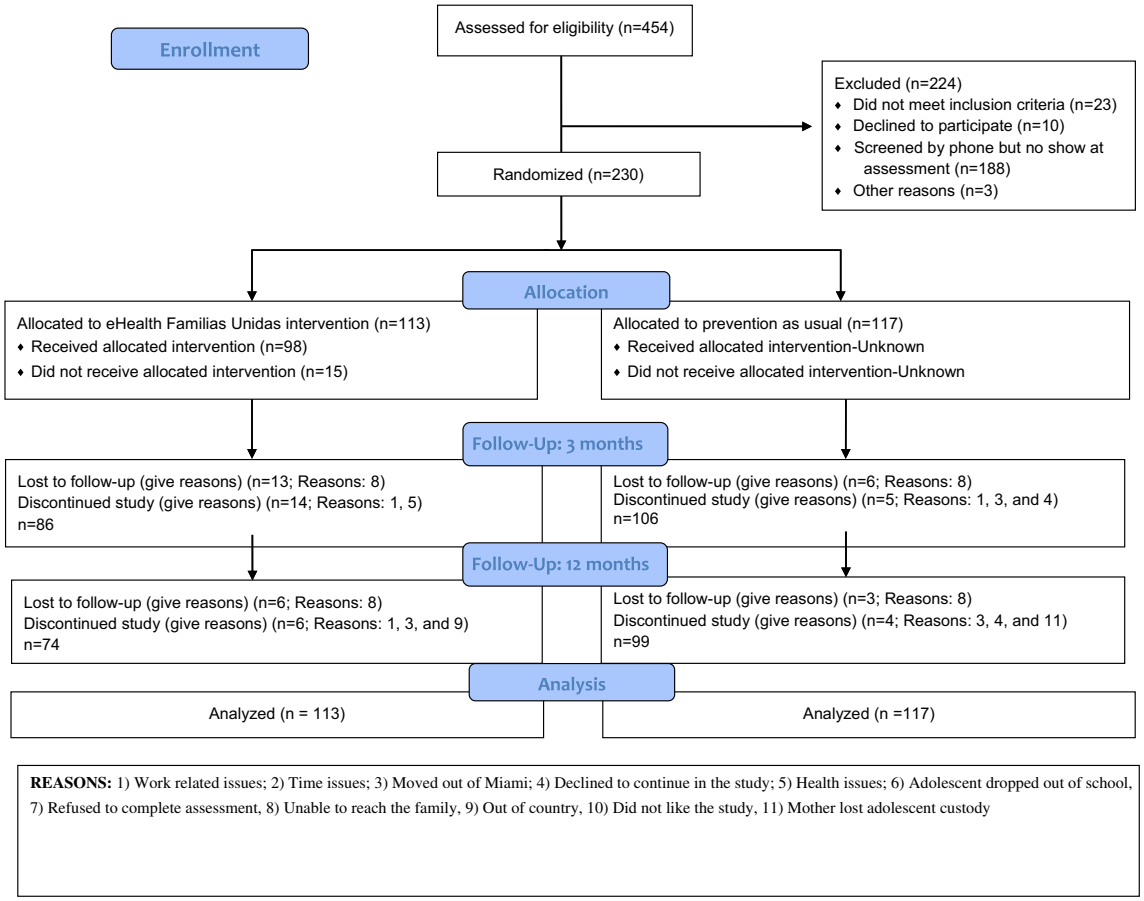

Fig. 1 CONSORT flow diagram

sessions consisted of three components: simulated parent group discussions, a culturally syntonic *telenovela* series (i.e., soap opera), and interactive exercises. The simulated parent group discussions featured a group of Hispanic parents who in real life were also the parents of adolescents. During the simulated discussions, parents discussed personal struggles associated with their adolescent, offered support, and provided suggestions on how to prevent adolescent risk behaviors. Additionally, the telenovela provided material for the parent actors to process intervention content, provided the context parent actors used to role-play new skills, and served as an engagement tool for the study parent participants to watch the intervention. Finally, the interactive exercises were used to reinforce intervention material, to adapt the participatory learning strategy used in the face-to-face intervention, and to tailor the intervention to the specific needs of each participating family. For example, through interactive exercises, parents identified goals for his/her adolescent that were later discussed and targeted during the family session with the facilitator.

Family Sessions Family sessions were conducted with a HIPAA-compliant online video conferencing software. Each family session was approximately 45 min in length and involved the adolescent with at least one primary caregiver. Consistent with precision prevention, the content of family sessions was tailored based on the goals and needs of each individual family. While there was a given set of information that needed to be covered in each session (e.g., communication skills, behavior management), this information was couched within the context, goals, and specific situation of each family.

Adherence Family sessions in the eHealth Familias Unidas condition were videotaped with participant consent. To evaluate adherence to the eHealth Familias Unidas intervention, raters evaluated 25% of the completed family sessions. Additionally, to assess inter-rater reliability, 10% of all rated sessions were also evaluated by a second independent rater. We used observational adherence measures from previous trials to identify key (prescribed) facilitator behaviors that were required in each session. Overall session quality ratings were made utilizing a Likert scale ranging from zero = *never/poor* to six = *extensively/excellent*. The average quality rating for the four family visits was 3.86 ($SD = 1.02$). Inter-rater reliability for the adherence measures was good across all domains ($\kappa = 1.00$).

Facilitators and Training The facilitator team consisted of 16 mental health professionals, all with master's level degrees in their fields (e.g., mental health counseling, social work). Eleven facilitators were full-time employees from the MDCPS system, and five were community clinicians. Six facilitators were already trained from a previous Familias Unidas effectiveness trial; ten were new to any version of the Familias Unidas intervention. Training was delivered by the research team's clinical supervisor, an experienced master's level clinician, and took place in a span of 3 days. Training included didactic instruction, role-plays, and group discussion of recorded sessions. Facilitators were also trained on technical components of the intervention such as how to track attendance and monitor attendance through the website. Facilitators received four 2-h supervision sessions delivered throughout the course of the intervention by both the first author and the clinical supervisor. We paid facilitators for recruiting, training, intervention delivery, and supervision.

Session completion Session completion for the e-parent group sessions was monitored by the facilitators through the intervention website, which was programmed to track when parents logged on, which sessions were viewed, and whether a session was partly or fully completed. Sessions were marked as completed only if watched fully. We built the website in a manner that prevented parents from fast forwarding or skipping through sessions.

Prevention as Usual Prevention as usual consisted of the HIV prevention curriculum provided by MDCPS via health and science classes. This curriculum has six lessons delivered in a classroom setting and aim to provide information about HIV/AIDS and other sexually transmitted infections. Parental permission was required for students to participate in the classes. Information regarding adolescent participation in these classes was not collected. Given that prevention as usual represents current community prevention activities (i.e., the MDCPS curriculum offered to all students), it is likely that participants from the experimental condition also received this curriculum.

Measures

A summary of the study variables and measures can be found in Table S1 available as supplementary online material.

Demographics Adolescents and primary caregivers completed a demographics questionnaire that included information regarding their gender, age, and national origin. Parents also responded to items concerning total household income.

Main Outcomes Drug (marijuana, cocaine, inhalants, and other drugs), prescription, cigarette, and alcohol use were assessed with items from a population-based epidemiologic survey, *Monitoring the Future* (Johnston et al. 2017). Specifically, we asked adolescents whether and how many times he or she had used a particular substance during the 90 days before each assessment time point. To assess the condomless sex outcome, items from the Sexual Behavior Instrument (Jemmott et al. 1998) were used to ask adolescents: (1) whether they had oral, vaginal, or anal sex, in the previous 90 days, and, if they responded "*yes*," (2) whether they used a condom during their last sexual encounter, measured on a five-point scale.

Secondary Outcomes We assessed family functioning at baseline and 3 months post baseline with parent reports of three indicators: (a) parent-adolescent communication, (b) parental monitoring of peers, and (c) positive parenting. The Parent-Adolescent Communication Scale (Barnes and Olson 1985), which evaluates effective communication, was used to assess parent-adolescent communication (20 items; $\alpha = 0.89$ [baseline] and 0.87 [3 months post baseline] for this study). Items were measured on a five-point scale. The Parent Relationship with Peer Group Scale (Pantin 1996) was used to obtain parental reports of actively supervising their adolescent and knowing their adolescent's friends (five items, $\alpha = 0.85$ [baseline] and 0.87 [3 months post baseline] for this study). The Parenting Practices Scale was used to assess positive parenting (Tolan et al.1997). Questions asked about positive parenting, rewards, and acknowledgments provided to adolescents in response to positive behaviors (nine items, $\alpha = 0.76$ [baseline] and 0.74 [3 months post baseline] for this study).

Data Analytic Strategy Data analyses consisted of four steps. First, chi-squared tests were used to test whether there were significant differences in attrition rates for target outcomes by condition. Second, Mann-Whitney *U* tests (for count variables), independent *t* tests (for continuous and normally distributed variables), and chi-squared tests (for categorical variables) were used to test for baseline differences on demographic and targeted outcome variables by condition. Third, given that the past 90-day drug use, prescription drug use, cigarette use, and alcohol use were count variables with a large number of zeros, we used zero-inflated Poisson growth models to estimate longitudinal changes across these targeted outcomes, including the effect of the two study conditions on the frequency of use as well as the likelihood of use (Olsen and Schafer 2001). If there were significant intervention effects on drug use by condition, as a post hoc test, we decomposed drug use into four specific drug categories (i.e., marijuana, cocaine, inhalants, and other drugs) to test condition effects separately for each of these outcome variables using multi-group tests.

To test intervention effects for the past 90-day condomless sex, we used categorical growth models by using a probit

parameter because this variable was measured as an ordinal item (Grimm and Liu 2016). Only participants who endorsed being sexually active were included in the analyses for the past 90-day condomless sex variable. Across all three study time points, 46 adolescents (20.0% out of the total sample size) reported having sex in the past 90 days. Across all growth models, time scores of the growth model were centered at the first time point (i.e., time coding of baseline = 0). The slope trajectory was estimated after controlling for the effects of the intercept by regressing the slope trajectory on initial levels. Therefore, the adjusted trajectory of the targeted outcome was estimated accounting for the baseline variation in the outcome (Grimm 2012).

Fourth, using structural equation modeling (SEM), we investigated intervention effects on the latent family functioning variable and its indicators from baseline to 3 months post baseline (i.e., post intervention; see Figure S1). Given that repeated latent family functioning variables for both baseline and 3 months post baseline were in the model, we first conducted a longitudinal measurement invariance test (Widaman et al. 2010) to determine whether the same latent family functioning variable was assessed across the two time points (baseline and 3 months post baseline). Next, intervention effects on the latent family functioning variable at 3 months post baseline were tested after controlling for baseline levels of the latent family functioning variable. If there was a significant intervention effect on the latent family functioning variable, as a post hoc test, the latent family functioning variable was decomposed to examine intervention effects on each family functioning indicator. Finally, we used the product of coefficients method to test whether the family functioning indicators mediated the effects of study condition on the outcomes (MacKinnon 2008).

Missing data for the repeated measures were addressed using full information maximum likelihood (FIML). To obtain accurate standard error estimates, a complex survey design was used to adjust for the clustering effect of students within schools. All analyses were conducted using Mplus version 7.2 (Muthén and Muthén 2002).

Results

Comparability of Conditions at Baseline and Follow-Up

Analyses indicated no significant differences at baseline by condition on demographic characteristics, adolescent risky behaviors, or family functioning variables except for parent-reported parent-adolescent communication which was higher for eHealth Familias Unidas participants compared to prevention as usual ($t = 2.31$, $p < .05$, $d = 0.30$) (Table S2). There were no differences in attrition rates across the three time points by study condition (12.3 and 5.2% for eHealth Familias Unidas and prevention as usual, respectively; $\chi^2 = 3.65$; $p = .056$). Out of 230 families that enrolled in the study, 65.5% ($n = 173$) remained in the study.

Session Completion

Overall session completion, including e-parent group sessions and family sessions, was 8.94 sessions ($SD = 4.87$) out of a possible 12 sessions. Parents completed a mean of 5.93 out of 8 possible e-parent group sessions. For the family sessions, an ordinal variable, 71.7% ($n = 81$) completed all four family sessions; 9.7% ($n = 11$) completed one, two, or three sessions; and 18.6% ($n = 21$) completed zero sessions. We did not collect session completion information for prevention as usual.

Main Outcomes: Tests of Intervention Effects

Results indicated that the trajectories for the past 90-day drug use between eHealth Familias Unidas and prevention as usual were statistically different ($b = -1.16$, 95% CI = −1.33, −1.00, $p < .001$) (see Table 1; Figure S2–S3 and Table S4 in supplementary materials). As a post hoc test, drug use was decomposed into four categories (i.e., marijuana, inhalants, cocaine, and other drugs) to examine intervention effects on each of these four outcomes. The results showed that the trajectories for the past 90-day drug use between eHealth Familias Unidas and prevention as usual were statistically different for past 90 day marijuana use ($b = -0.52$, 95% CI = −0.90, −0.15, $p < .01$) and inhalant use ($b = -1.19$.,

Table 1 Intervention effects on trajectories in the past 90-day drug, cigarette, and alcohol use and condomless sex

Trajectories	*b*	SE	95% CI	Effect size (*d*)[1]
Drug use	−1.16***	0.11	−1.33, −1.00	0.10
Marijuana	−0.52**	0.05	−0.90, −0.15	0.10
Inhalants	−1.19***	0.03	−1.64, −0.75	0.14
Cocaine	−0.11	0.24	−0.59, 0.37	0.06
Other drugs	0.06	0.12	−1.76, 0.40	0.05
Prescription drug use	−1.34**	0.50	−2.33, −0.35	0.15
Cigarette use	−1.05**	0.12	−1.72, −0.39	0.16
Alcohol use	0.02	0.13	−0.25, 0.28	0.07
Condomless sex	0.02	0.21	−0.31, 0.35	0.11

Drug use was summed from four different types of drugs (i.e., marijuana, inhalants, cocaine, and other drugs). Unstandardized coefficients are shown. Adjusted effects were estimated after controlling for the baseline effects.

SE standard error, *95% CI* 95% confidence interval, *AIC* Akaike information criteria, *BIC* Bayesian information criterion

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

[1] The difference between conditions (Familias Unidas vs. prevention as usual) in mean growth rates divided by the square root of slope variance

95% CI = − 1.64, − 0.75, $p < .001$). Multi-group tests indicated that the count trajectory for marijuana use in the past 90 days among eHealth Familias Unidas youth decreased across time points (mean trajectory = − 0.83, 95% CI = − 1.03, − 0.64, $p < .001$) whereas it increased over time (mean trajectory = 1.04, 95% CI = 0.76, 1.33, $p < .001$) among prevention as usual youth. For inhalant use, the results showed that the count trajectory for inhalant use in the past 90 days among eHealth Familias Unidas youth was stable across time points (mean trajectory = − 0.69, 95% CI = − 1.73, .34, $p = .19$) whereas it increased over time (mean trajectory = 0.97, 95% CI = 0.61, 1.33, $p < .001$) among prevention as usual youth. Results showed eHealth Familias Unidas was efficacious in reducing trajectories in past 90 day prescription drug use ($b = -1.34$, 95% CI = − 2.33, − 0.35, $p < .01$). The multi-group test showed that the count trajectory for prescription drug use in the past 90 days among eHealth Familias Unidas youth decreased across time points (mean trajectory = − 1.70, 95% CI = − 2.94, − 0.46, $p < .01$) whereas it was stable over time (mean trajectory = 0.03, 95% CI = − 0.01, .07, $p = .215$) among prevention as usual youth. Additionally, significant intervention effects where found for the trajectory of past 90-day cigarette use ($b = -1.05$, 95% CI = − 1.72, − 0.39, $p < .01$). The multi-group test showed that the trajectory of cigarette use in the past 90 days among eHealth Familias Unidas youth decreased across time points (mean trajectory = − 2.39, 95% CI = − 3.71, − 1.06, $p < .001$), whereas the trajectory of the past 90-day cigarette use in prevention as usual youth was stable over time (mean trajectory = 0.02, 95% CI = − 0.10, .13, $p = .775$). The intervention did not impact past 90-day alcohol use trajectories ($b = 0.02$, 95% CI = − 0.25, .28, $p = .623$).

For past 90 day condomless sex, we found no statistically significant intervention effects ($b = 0.02$, 95% CI = − 0.31, .35, $p = .89$).

Secondary Outcomes

Intervention Effects on Family Functioning from Baseline to 3 Months Post Baseline First, we conducted a longitudinal measurement invariance test. To systematically investigate whether the same latent family functioning factor structure was used between baseline and 3 months post baseline, we compared three nested models: (a) configure invariance (unconstrained model), (b) metric invariance in which the corresponding factor loadings are equivalent across measurement (i.e., time points), and (c) scalar invariance in which the respective factor loadings and indicator variable intercepts are equivalent across time. Next, we evaluated the nested models by comparing the comparative fit index (CFI; ≤ 0.01 invariance holds) (Cheung and Rensvold 2002). The results showed that the changes in the CFI between (1) the configure invariance model and the metric invariance model and (2) the metric invariance model and the scalar invariance model were 0.00 and 0.01, respectively, indicating that the same latent family functioning construct was used over time. Next, we tested intervention effects on the latent family functioning variable at 3 months post baseline after controlling for the baseline latent family functioning variable. The results showed that the intervention had a positive effect on the latent family functioning variable ($b = 1.39$, 95% CI = 0.30, 2.28, $p < .05$), indicating that eHealth Familias Unidas increased family functioning at 3 months post baseline. As a post hoc test, we decomposed the family functioning construct to test for intervention effects on each indicator. Results showed no significant intervention effects on any of the three individual family functioning indicators after adjusting for the effects of these indicators at baseline (parent-adolescent communication: $b = 1.65$, 95% CI = − 0.45, 3.84, $p = .12$; parental monitoring of peers: $b = 0.85$, 95% CI = − 0.09, 1.81, $p = .07$; positive parenting: $b = 0.13$, 95% CI = − 0.94, 1.22, $p = .80$).

Mediation Effects of Family Functioning The latent family functioning variable did not significantly mediate intervention effects for frequency of drug use ($a \times b1 = 0.032$, 95% CI = − 0.15, .22, $p = .738$), prescription drug use ($a \times b2 = 0.008$, 95% CI = − 0.037, .020, $p = .574$), cigarette use ($a \times b3 = 0.39$, 95% CI = − 1.70, 0.92, $p = .559$), alcohol use ($a \times b4 = 0.021$, 95% CI = − 0.061, 0.103, $p = .615$), or condomless sex ($a \times b5 = .003$, 95% CI = −.005, .011, $p = .527$). We also decomposed the family functioning indicators to individually test for mediation but found no significant mediating effects.

Discussion

The eHealth Familias Unidas intervention reduced overall drug use from baseline to 12 months post baseline compared to prevention as usual, which demonstrated increases in drug use across time, among Hispanic adolescents with problem behaviors. Specifically, marijuana use decreased across time for eHealth Familias Unidas youth, while it increased for prevention as usual youth. Further, eHealth Familias Unidas youth maintained baseline levels of inhalant use while it increased in prevention as usual youth. Additionally, eHealth Familias Unidas had a direct impact on reducing prescription drug use compared to prevention as usual. This is a significant finding given the limited number of interventions with an effect on prescription drug use and that the US Surgeon General Panel on Prescription Drug Abuse has made a call for preventive interventions that target prescription drug misuse (Spoth et al. 2013). In terms of cigarette use, eHealth Familias Unidas reduced use across time while baseline levels were maintained in prevention as usual. There were no intervention effects on alcohol use. It may be that, among Hispanic families, alcohol use is more acceptable, and, therefore,

intervention effects were not found for this outcome. This finding is consistent with previous Familias Unidas trials. Intervention effects for alcohol have only been found for youth with severe conduct difficulties, including youth involved with the juvenile justice system (Prado et al. 2012), further research is needed to understand these differences across trials.

eHealth Familias Unidas had a positive impact on family functioning, but not on any of the three individual level indicators. This may be explained by the fact that the latent family functioning variable was estimated after taking into account measurement error for all three family functioning indicators (Raykov and Marcoulides 2000), which allows for the separation of "true variance" (variance that is common among indicators) from "error variance" (variance due to other factors, including measurement error). This latent variable approach may correct attenuation bias for the regression weight and provide more accurate estimates of the relationship between intervention effects and family functioning. Given that the observed family functioning indicators (i.e., parent-adolescent communication, parental monitoring of peers, and positive parenting) include measurement errors (known as "residual variances"), the effect of the intervention on family functioning is more likely to be underestimated when observed family functioning indicators are directly specified in the model (known as "attenuation bias of regression weight"; Baron and Kenny 1986).

We did not find main effects for condomless sex. A possible explanation for this lack of intervention effects is that, due to budgetary constraints, the sample was not followed for a sufficiently long enough period of time. Previous Familias Unidas trials have shown delayed effects for this outcome that were uncovered at 30 months post baseline or later (e.g., Prado et al. 2007; Pantin et al. 2009). In this study, adolescents were followed for 12 months. Indeed, there is some data to support this possibility. Specifically, we calculated effect sizes for the past 90-day condomless sex trajectories at the 12-month post baseline point for this study and for the most recent face-to-face Familias Unidas trial that had a longer follow-up (Estrada et al. 2017b). At the 12-month post baseline assessment follow-up, the current study had a similar effect size for condomless sex trajectories (b [SE] = − 0.11, $p = .55$, effect size $d = 0.11$) compared to the face-to-face trial (b [SE] = − 0.02, $p = .79$, effect size $d = 0.12$). Significant results on condomless sex were found for the 30-month post baseline in the face-to-face trial; therefore, the possibility exists that if the current sample would have been followed for a longer period, effects may have been present. Alternatively, it is possible that rates were too low to detect group differences. Because condom use remains a strong factor for HIV/STI risk reduction, even in the age of biomedical interventions such as pre-exposure prophylaxis, further research is needed to understand how to best measure and impact this outcome.

Given the growth of eHealth interventions over the last decade and the underrepresentation of ethnic/racial minorities in randomized controlled trials, understanding whether and how eHealth interventions work among these populations is important, particularly due to the increasingly diverse nature of the US population and persistent health disparities. The use of video-recorded, eHealth interventions may help ameliorate the perennial challenge of engaging and retaining research participants by offering increased intervention flexibility and convenience (Perrino et al. in press). Nonetheless, researchers point to the need for "supportive accountability" in the delivery of eHealth interventions. Supportive accountability includes the presence of a coach that creates accountability to participation goals, oversees progress, and establishes a bond with the participant (Mohr et al. 2011, 2013; Perrino et al. in press). This kind of human support in the delivery of eHealth interventions can be utilized as a means for increasing participation (Mohr et al. 2011, 2013; Perrino et al. in press) and may have contributed to our relatively high session completion rate (approximately 9 out of 12 possible sessions).

Although eHealth interventions may help circumvent challenges in reach, fidelity, and delivery, they may not be appropriate for all families. In line with precision prevention, future investigations with the Familias Unidas program of research should investigate what works best for families and whether different levels of youth risk require one modality over the other (i.e., face-to-face Familias Unidas vs eHealth Familias Unidas). Understanding how preventive interventions work among subpopulations such as Hispanics is an important step in advancing precision prevention. Future research should also investigate whether eHealth Familias Unidas can be delivered by non-mental health professionals. Indeed, research with eHealth Familias Unidas has begun to look at this in an ongoing trial examining the effectiveness of eHealth Familias Unidas as delivered by primary care pediatric clinic personnel including administrative staff, clinic interns, and nurse practitioners.

Several limitations should be considered when examining findings in this study. First, as in all clinical trials, there is a potential inherent self-selection bias that exists for participants that decide to participate in a research study. Given that we did not consent participants who declined study participation, we did not collect information to compare whether they differ from those who did participate. Second, we did not gather information on services received by the prevention as usual group. Future studies should incorporate collection of this information as part of the assessment administered to participants. Finally, because all measures were self-report, there exists the potential for social desirability bias. Nonetheless, previous research has shown that the use of the ACASI software mitigates this bias (Turner et al. 1998).

This study demonstrated the efficacy of an eHealth intervention delivered to Hispanic families by facilitators from a

community setting. While there has been a proliferation of interventions for use on the Internet, few researchers have evaluated the efficacy of these electronic based modalities among Hispanic populations. To our knowledge, this is the first; therefore, informing an extant literature gap, particularly in regard to family-based prevention of drug use and sexual risk behaviors such as condomless sex, two areas needing prevention efforts for Hispanics. The Internet has become a popular source for health information (Hudnut-Beumler et al. 2016; Bennet and Glasgow 2009), but while most Internet interventions are very structured, psychoeducational, and self-guided (Bennet and Glasgow 2009), eHealth Familias Unidas is participatory in nature and family centered. Interventions such as eHealth Familias Unidas have the potential for facilitating the implementation of evidence-based interventions to populations that are not reached with other intervention modalities and for reducing health disparities among minorities.

Acknowledgments This study was funded by a grant from the Centers for Disease Control and Prevention, grant U01PS000671 (PI: Yannine Estrada). We would like to express sincere appreciation to all the families who participated in this study. Additionally, thank you for the support from Miami-Dade County Public Schools.

Compliance with Ethical Standards

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

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

Human Subjects All participants in this study signed informed consent or assent. The University of Miami's Human Subject Research Office and Miami-Dade County Public Schools Research Review Committee approved this study. Study activities were carried out according to the ethical standards specified by the 1964 Declaration of Helsinki and its later amendments.

References

Aarons, G. A., & Sawitzky, A. C. (2006). Organizational climate partially mediates the effect of culture on work attitudes and staff turnover in mental health services. *Administration and Policy in Mental Health Services Research, 33*, 289–301. https://doi.org/10.1007/s10488-006-0039-1.

Barnes, H., & Olson, D. (1985). Parent-adolescent communication and the circumplex model. *Child Development, 56*, 438–447. https://doi.org/10.2307/1129732.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Psychological Bulletin, 51*, 1173–1182.

Bell, S. G., Newcomer, S. F., Bachrach, C., Borawski, E., Jemmott, J. L., Morrison, D., et al. (2007). Challenges in replicating interventions. *Journal of Adolescent Health, 40*, 514–520. https://doi.org/10.1016/j.jadohealth.2006.09.005.

Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the Internet: Actualizing their potential. *Annual Review of Public Health, 30*, 273–292. https://doi.org/10.1146/annurev.publhealth.031308.100235.

Centers for Disease Control and Prevention (2017a). High school YRBS. Retrieved from https://nccd.cdc.gov/youthonline.

Centers for Disease Control and Prevention (2017b). HIV incidence: Estimated annual infections in the U.S., 2008–2014. Overall and by transmission route. *CDC Fact sheet*. Retrieved from https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/hiv-incidence-fact-sheet_508.pdf.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5.

Ellickson, P. L., Tucker, J. S., Klein, D. J., & Saner, H. (2004). Antecedents and outcomes of marijuana use initiation during adolescence. *Prevention Medicine, 39*, 976–984. https://doi.org/10.1016/j.ypmed.2004.04.013.

Estrada, Y., Lee, T. K., Huang, S., Tapia, M. I., Velázquez, M. R., Martínez, M. J., et al. (2017b). Parent-centered prevention of risky behaviors among Hispanic youths in Florida. *American Journal of Public Health, 107*, 607–613. https://doi.org/10.2105/AJPH.2017.303653.

Estrada, Y., Molleda, L., Murray, A., Drumhiller, K., Tapia, M., Sardinas, K., et al. (2017a). eHealth Familias Unidas: An internet adaptation of an evidence-based family intervention to reduce drug use and sexual risk behaviors among Hispanic adolescents. *International Journal of Environmental Research and Public Health, 14*, E264. https://doi.org/10.3390/ijerph14030264.

File, T.&Ryan, C. (2014). Computer and Internet use in the United States: 2013. *American Community Survey Reports, ACS-28*. Washington, D.C.: U.S. Census Bureau. Retrieved from http://www.census.gov/content/dam/Census/library/publications/2014/acs/acs-28.pdf.

Gillman, M. W., & Hammond, R. A. (2016). Precision treatment and precision prevention, integrating below and above the skin. *JAMA Pediatrics, 170*, 9–10. https://doi.org/10.1001/jamapediatrics.2015.2786.

Gladstone, T. G., Marko-Holguin, M., Rothberg, P., Nidetz, J., Diehl, A., DeFrino, D. T., et al. (2015). An internet-based adolescent depression preventive intervention: Study protocol for a randomized controlled trial. *Trials, 16*, 203. https://doi.org/10.1186/s13063-015-0705-2.

Grimm, K. J. (2012). Intercept centering and time coding in latent difference score models. *Structural Equation Modeling, 19*, 137–151. https://doi.org/10.1080/10705511.2012.634734.

Grimm, K. J., & Liu, Y. (2016). Residual structures in growth models with ordinal outcomes. *Structural Equation Modeling, 23*, 466–475. https://doi.org/10.1080/10705511.2015.1103192.

Hudnut-Beumler, J., Po'e, E., & Barkin, S. (2016). The use of social media for health promotion in Hispanic populations: A scoping systematic review. *JMIR Public Health and Surveillance, 2*(2), e32. https://doi.org/10.2196/publichealth.5579.

Ingoldsby, E. M. (2010). Review of interventions to improve family engagement and retention in parent and child mental health programs. *Journal of Child and Family Studies, 19*, 629–645. https://doi.org/10.1007/s10826-009-9350-2.

Jemmott III, J. B., Jemmott, L. S., & Fong, G. T. (1998). Abstinence and safer sex HIV risk-reduction interventions for African American adolescents: A randomized controlled trial. *Journal of the American Medical Association, 279*, 1529–1536.

Johnston, L. D., O'Malley, P. M., Miech, R. A., Bachman, J. G., & Schulenberg, J. E. (2017). *Monitoring the Future national survey results on drug use, 1975–2016: Overview, key findings on adolescent drug use*. Ann Arbor, MI: Institute for Social Research

Retrieved from http://www.monitoringthefuture.org//pubs/monographs/mtf-overview2016.pdf.

Kann, L., McManus, T., Harris, W. A., Shanklin, S. L., Flint, K. H., Hawkins, J., et al. (2016). Youth risk behavior surveillance—United States, 2015. *Morbidity and Mortality Weekly Report (MMWR), 65*, 1–174 Retrieved from https://www.cdc.gov/mmwr/volumes/65/ss/ss6506a1.htm.

Knapp, C., Madden, V., Wang, H., Sloyer, P., & Shenkman, E. (2011). Internet use and eHealth literacy of low-income parents whose children have special health care needs. *Journal of Medical Internet Research, 13*, e75. https://doi.org/10.2196/jmir.1697.

MacDonnell, K. W., & Prinz, R. J. (2016). A review of technology-based youth and family-focused interventions. *Clinical Child and Family Psychology Review, 20*, 185–200.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Lawrence Erlbaum.

Marsch, L. A., Grabinski, M. J., Bickel, W. K., Desrosiers, A., Guarino, H., Muehlbach, B., et al. (2011). Computer-assisted HIV prevention for youth with substance use disorders. *Substance Use and Misuse, 46*(1), 46–56. https://doi.org/10.3109/10826084.2011.521088.

Mendez, J. L., Carpenter, J. L., LaForett, D. R., & Cohen, J. S. (2009). Parental engagement and barriers to participation in a community-based preventive intervention. *American Journal of Community Psychology, 44*, 1–14. https://doi.org/10.1007/s10464-009-9252-x.

Metzger, D. S., Koblin, B., Turner, C., Navaline, H., Valenti, F., Holte, S., et al. (2000). Randomized controlled trial of audio computer-assisted self-interviewing: Utility and acceptability in longitudinal studies. *American Journal of Epidemiology, 152*, 99–106. https://doi.org/10.1093/aje/152.2.99.

Mohr, D. C., Burns, M. N., Schueller, S. M., Clarke, G., & Klinkman, M. (2013). Behavioral intervention technologies: Evidence review and recommendations for future research in mental health. *General Hospital Psychiatry, 35*, 332–338. https://doi.org/10.1016/j.genhosppsych.2013.03.008.

Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: A model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research, 13*, e30.

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *JAMA, 291*, 1238–1245. https://doi.org/10.1001/jama.291.10.1238.

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling, 9*, 599–620. https://doi.org/10.1207/S15328007SEM0904_8.

Nagler, R. H., Ramanadhan, S., Minsky, S., & Viswanath, K. (2013). Recruitment and retention for community-based eHealth interventions with populations of low socioeconomic position: Strategies and challenges. *Journal Community, 63*, 201–220. https://doi.org/10.1111/jcom.12008.

National Research Council & Institute of Medicine [NRC&IM]. (2009). *Implementation and dissemination. Preventing mental, emotional, and behavioral disorders among young people, progress and possibilities* (pp. 297–336). Washington, D.C.: The National Academies Press.

Newton, N. C., Andrews, G., Champion, K. E., & Teeson, M. (2014). Universal internet-based prevention for alcohol and cannabis use reduces truancy, psychological distress and moral disengagement: A cluster randomized controlled trial. *Preventive Medicine, 65*, 109–115. https://doi.org/10.1016/j.ypmed.2014.05.003.

Noar, S. M., Black, H. G., & Pierce, L. B. (2009). Efficacy of computer technology-based HIV prevention interventions: A meta-analysis. *AIDS, 23*, 107–115. https://doi.org/10.1097/QAD.0b013e32831c5500.

Olsen, M. K., & Schafer, J. L. (2001). A two-part random-effects model for semicontinuous longitudinal data. *Journal of the American Statistical Association, 96*, 730–745.

Pantin, H. (1996). *Ecodevelopmental measures of support and conflict for Hispanic youth and families*. Miami, FL: University of Miami Miller School of Medicine.

Pantin, H., Coatsworth, J. D., Feaster, D. J., Newman, F. L., Briones, E., Prado, G., Schwartz, S. J., & Szapocznik, J. (2003). Familias Unidas: The efficacy of an intervention to promote parental investment in Hispanic immigrant families. *Prevention Science, 4*, 189–201.

Pantin, H., Prado, G., Lopez, B., Huang, S., Tapia, M. I., Schwartz, S. J., et al. (2009). A randomized controlled trial of Familias Unidas for Hispanic adolescents with behavior problems. *Psychosomatic Medicine, 71*, 987–995. https://doi.org/10.1097/PSY.0b013e3181bb2913.

Perrino, T., Estrada, Y., Huang, S., St. George, S., Pantin, H., Cano, M. A., et al. (in press). Predictors of participation in an eHealth, family-based preventive intervention for Hispanic youth. *Prevention Science*. Advance online publication. https://doi.org/10.1007/s11121-016-0711-y.

Prado, G., Córdova, D., Huang, S., Estrada, Y., Rosen, A., Bacio, G. A., et al. (2012). The efficacy of Familias Unidas on drug and alcohol outcomes for Hispanic delinquent youth: Main effects and interaction effects by parental stress and social support. *Drug and Alcohol Dependence, 125*(Supplement 1), S18–S25. https://doi.org/10.1016/j.drugalcdep.2012.06.011.

Prado, G., Pantin, H., Briones, E., Schwartz, S., Feaster, D., Huang, S., et al. (2007). A randomized controlled trial of a parent-centered intervention in preventing substance use and HIV risk behaviors in Hispanic adolescents. *Journal of Consulting and Clinical Psychology, 75*, 914–926. https://doi.org/10.1037/0022-006X.75.6.914.

Raykov, T., & Marcoulides, G. A. (2000). *A first course in structural equation modeling*. Mahwah, NJ: Erlbaum.

Spoth, R., Trudeau, L., Shin, C., Ralston, E., Redmond, C., Greenberg, M., & Feinberg, M. (2013). Longitudinal effects of universal preventive intervention on prescription drug misuse: Three randomized controlled trials with late adolescents and young adults. *American Journal of Public Health, 103*, 665–672. https://doi.org/10.1037/a0016029.

Tolan, P. H., Gorman-Smith, D., Huesmann, L. R., & Zelli, A. (1997). Assessment of family relationship characteristics: A measure to explain risk for antisocial behavior and depression among urban youth. *Psychological Assessment, 9*, 212–223. https://doi.org/10.1037/1040-3590.9.3.212.

Turner, C. F., Ku, L., Rogers, S. M., Lindberg, L. D., Pleck, J. H., & Sonenstein, F. L. (1998). Adolescent sexual behavior, drug use, and violence: Increased reporting with computer survey technology. *Science, 280*, 867–873. https://doi.org/10.1126/science.280.5365.867.

U.S.Census Bureau (2015). Annual estimates of the resident population by sex, age, race, and Hispanic origin for the United States: April 1, 2010 to July 1, 2014. Retrieved from https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

Viswanath, K. (2011). Cyberinfrastructure: An extraordinary opportunity to bridge health and communication inequalities? *American Journal of Preventive Medicine, 40*(Suppl 2), S245–S248. https://doi.org/10.1016/j.amepre.2011.02.005.

Widaman, K. F., Ferrer, E., & Conger, R. D. (2010). Factorial invariance within longitudinal structural equation models: Measuring the same construct across time. *Child Development Perspectives, 4*, 10–18. https://doi.org/10.1111/j.1750-8606.2009.00110.x.

Zayas, L. H., Borrego, J., & Domenech Rodriguez, M. M. (2009). Parenting interventions and Latino families. Research findings, cultural adaptations, and future directions. In F. A. Villarruel, G. Carlo, J. M. Grau, M. Azmitia, N. J. Cabrera, & T. J. Chahin (Eds.), *Handbook of U.S. Latino psychology: Developmental and community-based perspectives* (pp. 291–307). Thousand Oaks, CA: Sage.