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A randomized clinical trial testing the effectiveness of an adapted online HIV/AIDS prevention intervention among Latino men

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Several factors exacerbate the risk of HIV infection among Latino men, including low HIV/AIDS knowledge, low perception of HIV risk, and higher related stigma, as well as limited access to health care prevention services. HoMBRES de Familia was a randomized controlled trial to adapt and test the efficacy of an intervention that was implemented with Latino men in semi-rural and urban areas of Miami-Dade County. The HoMBRES de Familia intervention, conducted during the COVID-19 pandemic, aimed to reduce the risk of substance abuse, intimate partner violence, and HIV/AIDS (i.e., SAVA syndemic) among Latino men. Participants ($n=122$) were randomly assigned to either the intervention or the control group with a 1:1 ratio. Participants were interviewed by phone in the language of their preference at baseline and at 6-month follow-up after the intervention. Control group received one diabetes prevention session while the HoMBRES de Familia intervention consisted of four video sessions on HIV, substance use, and intimate partner violence prevention. Results suggest that this intervention was effective in increasing HIV knowledge and HIV self-efficacy, as well as reducing risky sexual behaviors among the intervention group participants. We discuss possible effects of the pandemic on participants' levels of stress and alcohol use quantity and potential impacts on problematic drinking for Latino men.

Keywords Semi-rural, Latino/Hispanic, Latino men, HIV intervention, Urban latino, COVID-19

Latinos are the largest ethnic minority group in the United States (U.S.), accounting for 19% of the population¹ and representing almost one-third of all HIV/AIDS cases². In 2019, Latinos ranked 2nd highest among new HIV diagnoses after Black/African Americans, and Latinos were 4.2 times more likely to be diagnosed with HIV than their White counterparts³. By 2022, Latinos comprised 32% of all new HIV diagnoses an increase of 17% in new HIV diagnoses since 2018². In contrast, Blacks/African Americans experienced a 5% reduction in HIV diagnoses during the same period. More staggering is the gender difference in HIV diagnoses across ethno-racial groups, with men being significantly more at-risk for HIV infection than women, underscoring an increasing need for targeted interventions among Latino men specifically.

Risk of HIV/AIDS among Latino men is influenced by a myriad of factors, such as low HIV/AIDS knowledge, low perception of HIV risk, and greater HIV/AIDS related stigma⁴. Certain aspects of traditional masculine gender roles that encourage men to engage in increased alcohol use⁵, have multiple romantic partners, and engage in unprotected sex may also contribute to increased HIV risk^{6,7}. Among Latino men specifically, these

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cultural factors are critical, as alcohol use and sexual risk behaviors are major HIV-related risk factors⁸; these risk factors often intersect with other health conditions (e.g., depression and anxiety)⁹ and are intensified in environments where intimate-partner violence is prevalent¹⁰, highlighting the complex and interconnected nature of HIV vulnerability. Primarily, Latino men living in semi-rural and rural areas have lower engagement in HIV-testing, and they receive later HIV diagnosis and treatment, making them particularly susceptible to increased risk for HIV-related mortality. In turn, scholars have called for the continuum of HIV care and preventative efforts into rural areas as HIV has expanded beyond being an exclusively urban issue¹¹. Considering that the risk of HIV/AIDS infection is magnified by comorbid health and psychosocial conditions affecting vulnerable populations¹², understanding syndemic factors related to HIV and implementing multidimensional interventions is a promising direction to address the HIV epidemic among Latino men. To this end, the present study implemented a culturally adapted intervention aimed at reducing the risk of substance abuse, violence, and HIV/AIDS (SAVA syndemic) among Latino men in urban and semi-rural areas of Miami-Dade County.

HIV knowledge and self-efficacy

As previously mentioned, Latino men may be at increased risk for HIV infection due to lack of basic HIV/AIDS-related knowledge and cultural stigma related to HIV/AIDS that worsens misinformation, particularly among Latino men living in rural communities^{6,13}. Other factors such as language barriers and fear of deportation also play a role in increased risk of HIV infection^{6,13,14}. For example, fear of deportation and legal consequences among Latino immigrants with unauthorized legal status may cause them to engage in infrequent healthcare seeking behavior, which can lead to a lack of HIV prevention knowledge and self-efficacy (i.e., a person's belief in their personal ability to carry out necessary actions and perform a specific behavior)^{4,15-18}. Moreover, condom use self-efficacy is related to an individual's assessment of his competence to exercise control when making condom use decisions¹⁹. Increased condom self-efficacy is related to greater efficacy using condoms and negotiations of condom use in sexual relationships²⁰. However, existing studies suggest there are knowledge gaps in condom use self-efficacy among this population²¹. It is likely that specific social and structural barriers faced by Latino men may directly or indirectly affect self-efficacy through risky sexual behaviors, such as sex without condoms and sex under the influence of alcohol. Research has shown that interventions aimed at enhancing self-efficacy can significantly improve HIV prevention behaviors among Latino men²². These interventions often focus on building skills, increasing knowledge, and providing culturally relevant support, which are essential for empowering individuals to take control of their sexual health²³.

Alcohol use

Although alcohol use varies among Latino subgroups^{17,24} and Latinos are generally less likely than their non-Latino White counterparts to drink, those who do drink tend to report drinking more than Whites²⁵. Latinos may also experience conditions that worsen the risk of alcohol misuse, such as higher rates of poverty and marginalization¹⁰. Gender also has been shown to play a fundamental role in alcohol use; typically, men report greater alcohol use than women^{25,26}. In a study by Sanchez et al. (2015), most men claimed to use alcohol occasionally and to only have four drinks or less in one sitting⁵. However, a large proportion of men (25%) also reported drinking every day or nearly every day and 35% reported binge drinking (i.e., 4 or more drinks for women and 5 or more drinks for men in one sitting)⁵. Within the Latino community, alcohol use has been associated with higher stress among migrant workers, and it has also been associated with higher levels of acculturation. Additionally, Latinos in the US have a broadly relaxed view toward alcohol use in contexts such as family festivities. Although research on alcohol use among Latinos has advanced, few empirical studies have examined the variation among Latino groups^{17,24,27,28}. As the Latino population in the U.S. is rapidly changing, with more second-generation Latinos and population growth among Latinos from countries such as Venezuela, Honduras, Dominican Republic, and Guatemala²⁹, empirical research that is inclusive of Latinos and examines Latino heterogeneity and other sociocultural factors has become increasingly important.

Intimate partner violence

Physical, emotional, sexual, and stalking abuse by a former or current partner is categorized as intimate partner violence (IPV)^{30,31}. IPV has been associated with negative health consequences related to substance use, mental health, and physical health, including anxiety and depression, as well as chronic pain and cardiovascular problems³²⁻³⁴. As reported by the CDC³⁴, roughly 26% of men and 47% of women have experienced IPV in some capacity in their lifetime. The ramifications of IPV are extensive, such that 75% of women and 48% of men report experiences of physical harm. Physical violence is the most prevalent form of violence reported by men; nationally surveyed Latino men reported lifetime physical violence similar to their White counterparts (28.2% vs. 26.6%) but less than African Americans (38.6%). Homicide data show that 1 in 5 homicides are a result of IPV, and more than half of female homicides are carried out by the partner³⁴. Yet, limited research is available with regard to male victims and survivors of IPV. It is possible that IPV among men, and in particular Latino men, is underreported due to stigma associated with gender assigned roles, lack of knowledge, and fear of legal retaliation such as deportation³⁵.

Syndemic framework

A combination of socio-demographic, ecological, and behavioral factors contribute to the disproportionate rates of substance abuse, violence, and HIV/AIDS (SAVA) syndemic among Latino individuals in the U.S.³⁶. SAVA conditions refer to two or more intertwined endemic or epidemic health conditions¹⁵. The SAVA syndemic framework highlights the interplay of multiple comorbid health conditions and how these health conditions may interact, synergistically, to negatively impact the health of affected communities¹⁵. More specifically, the syndemic framework considers (a) how comorbid conditions reinforce themselves, in addition to (b) underlying

socio-demographic individual (e.g., education, substance abuse), interpersonal (e.g., marital status), cultural (e.g., male gender norms, cultural stressors), and socio-environmental factors (nationality, structural stressors) that may serve as common risk factors for these conditions (i.e., substance abuse, violence, and HIV/AIDS).

When investigating health concerns among the Latino population, using the SAVA framework may be particularly helpful in providing a more nuanced understanding of the underlying factors that link comorbid health and health disparity conditions. For example, studies have shown that Latino men living in urban settings who engage in increased alcohol consumption are also more likely to engage in unprotected sex and have multiple sexual partners¹⁰. Engagement in this risky behavior is further exacerbated in environments where intimate-partner violence is prevalent¹⁰. Concurrently, while alcohol use can lead to intimate-partner violence, intimate-partner violence can lead to an increase in unprotected sexual activity. Among Latino men specifically, pressure to conform to traditional male gender roles also can inhibit these men from seeking help for, and discussing, both substance abuse and intimate partner violence, increasing their risk of HIV infection and worsening health outcomes. Together, intimate violence, alcohol misuse, and risky sexual behaviors interact to increase HIV rates among Latino men. By understanding and addressing these interconnected issues within their broader social, economic, and cultural contexts, more effective and holistic interventions can be developed to improve the health and well-being of the Latino community.

Various obstacles may hinder effective health prevention programming, including geographical isolation, high mobility, lack of access to media, poverty, difficulties with language and literacy, stigmatization and other structural variables excluded in the present analysis^{6,7}. Thus, there is a critical need for tailored interventions, particularly addressing underlying multi-level factors that can potentially and simultaneously reduce substance abuse, violence, and HIV risk behaviors among Latino heterosexual men^{6,14,36}. Given the extant literature review and the SAVA syndemic effect among Latino men, the goal of the present study (i.e., the HoMBRES de Familia) was to adapt and test the efficacy of a culturally adapted intervention on increasing HIV knowledge, self-efficacy, and decreasing substance abuse and intimate-partner violence among Latino men living in urban and semi-rural areas of Miami-Dade County. In the present study, high risk sexual behaviors included having sex with multiple partners, having sex without condoms, having anal sex, and having sex under the influence of alcohol and other substances. Although the current community based intervention was originally designed for in-person group settings, the sudden onset of the COVID-19 pandemic necessitated a shift to a virtual intervention format, to ensure participant accessibility and safety. Interactive, educational pre-recorded video sessions were a practical solution that enabled us to swiftly continue providing the culturally appropriate prevention intervention in the target community sample. The adaptation of interventions to video formats during the pandemic has been supported by various studies^{14,37,38}.

Method

Design and procedures

The present study follows the Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized clinical trials³⁹. This study's registry identifier is NCT03730987. The study was registered on 04/19/2019 and completed on 07/30/2021; its protocol and statistical plan can be found at: Study Protocol and Statistical Analysis Plan, https://cdn.clinicaltrials.gov/large-docs/87/NCT03730987/Prot_SAP_001.pdf Informed Consent Form, https://cdn.clinicaltrials.gov/large-docs/87/NCT03730987/ICF_000.pdf.

Interventions: Data for this randomized clinical study are from the HoMBRES de Familia (Hispanic Men Building Respect, Education, and Safety within Families /Hombres Manteniendo Respeto, Educación y Seguridad en la Familia) intervention, a trial that evaluated the effectiveness of an HIV knowledge, self-efficacy, and intimate partner violence prevention intervention. Due to social distancing guidelines imposed by institutional, state, and federal entities in response to the COVID-19 pandemic, this study was conducted remotely. The adapted culturally tailored videotraining was facilitated by a Latino male post-doctoral level team member who was available to answer questions during and after the online video sessions. The HoMBRES de Familia intervention is an adapted version of two Center for Disease Control (CDC) evidence-based prevention interventions: (1) Hombres Manteniendo Bienestar y Relaciones Saludables / Men Maintaining Wellbeing and Healthy Relationships (HoMBReS), which was designed specifically to reduce HIV infection among Latino men living in semi-rural areas⁴⁰; and (2) Families Talking Together (FTT), an evidence-based intervention designed to decrease partner violence and domestic violence and increase family communication⁴¹. The CDC approved the evidence-based HoMBReS intervention as part of its Diffusion of Effective Behavioral Interventions (DEBI) program. The intervention trained soccer team members as health lay advisors to offer advice to other team members about sexual behaviors, HIV, and condom use. The lay health advisors received a total of 16 hours of training, and the intervention resulted in significantly reducing risky sexual behaviors and HIV prevention in a sample of Latino men in rural North Carolina. In the present study, the adapted HoMBRES de Familia intervention is a culturally specific intervention targeting Latinos that focuses on building condom use self-efficacy skills through pre-recorded video demonstrations, role playing, and other skill building exercises to reduce HIV infection, the use of alcohol, and intimate partner violence^{40,42}. The adapted HoMBRES de Familia interactive intervention videos were approximately 1.5-hour long; sessions included communication skills based on the FTT and feedback from focus groups conducted with a community advisory board.

Participants in the control group received a single 1.5-hour video focusing on diabetes prevention⁴¹ within a week after the baseline interview. All participants in the intervention group were paced to no more than two videos per week; additionally, participants in both arms received follow-up phone calls to discuss topics covered in the videos and lessons learned, and to offer referrals if needed and address any questions. Four 1.5-hour sessions in Spanish were watched by participants in the intervention arm over a 2–3 -week period. Throughout each video, the facilitator was available to help via a follow-up phone call. Participants in the control and intervention groups received pre- and post-interview incentives of \$50 and \$80, respectively. After each one of

the video sessions and their follow-up phone call, participants in the intervention group received a total of \$150 in incentives (\$30, \$35, \$40, and \$45 respectively). Upon finishing the single diabetes prevention instructional video session and the follow-up phone call, the control group participants received a \$25 incentive. When the video link was sent to participants in both control and intervention groups, a follow-up phone call addressed any questions and ensured participants had a quiet area to view the full video and ask questions if needed.

Recruitment and randomization: Participants were recruited from November 2019 to October 2020, using conventional methods such as word of mouth, flyers, radio, and social media advertisements in Miami-Dade (Fig. 1). Participants from the target population could refer to the study up to three other friends. Once participants were screened for inclusion criteria; they were randomized 1:1 into the intervention or control group. Randomization was performed by the project coordinator using the computer software RAND12⁴³ using participants' IDs to assign them to the groups. Participants and interviewers were blinded until after the baseline data were collected. Participants were interviewed at the time, day, and in the language (i.e., English or Spanish) of their preference. Data were collected using Research Electronic Data Capture (REDCap), and the survey and data management software was used to manage and clean the data. After the approximately one-hour survey interview, the project coordinator scheduled dates and times to view the intervention videos.

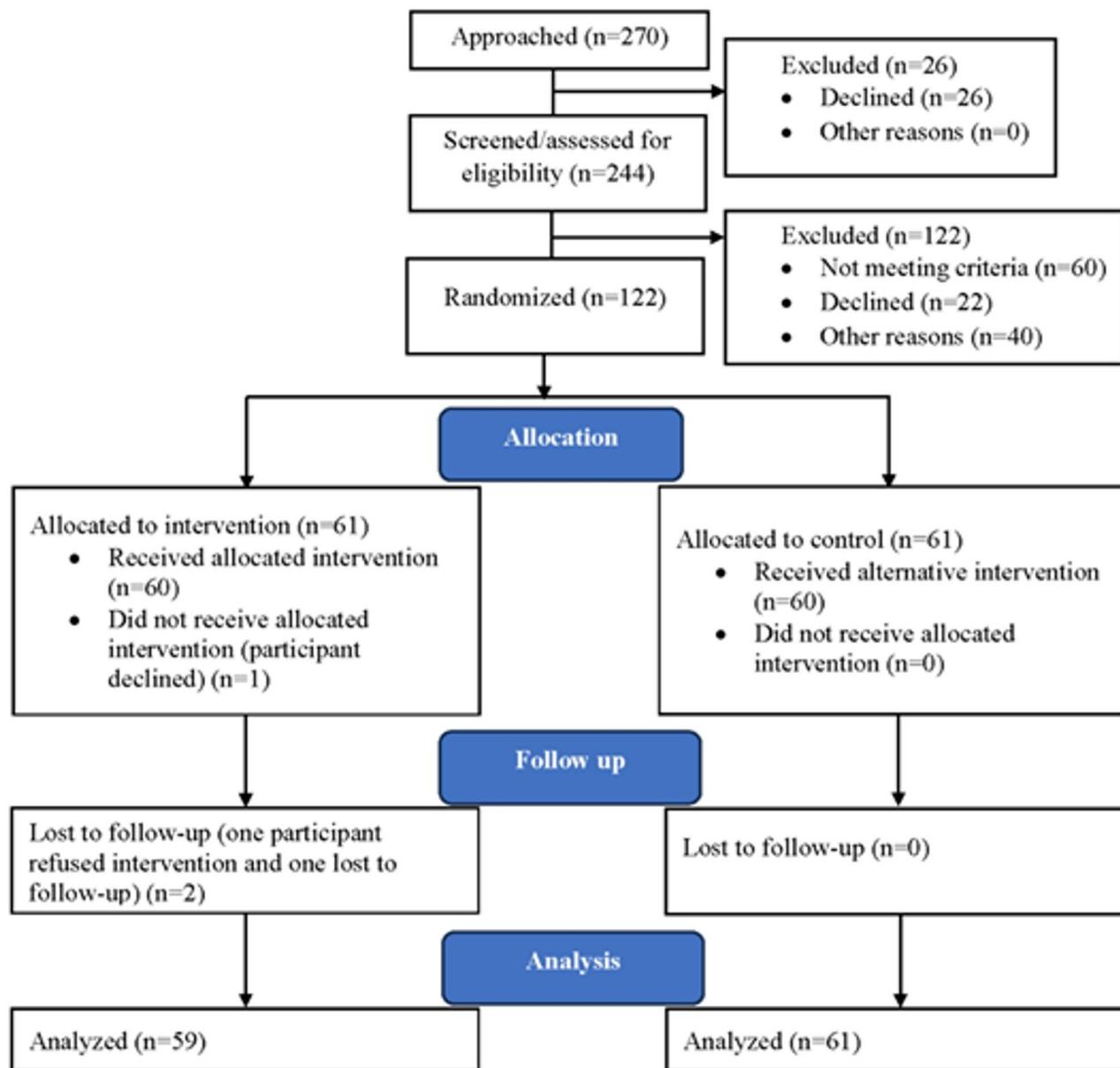


Fig. 1. Participants enrollment flow diagram.

Ethics declarations and approval for human experiments

The present study was funded by the National Institute on Minority Health and Health Disparities and approved by the Institutional Review Board (IRB) of Florida International University. Informed consent was obtained from all individual participants included in the study. All procedures performed in the present study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Deidentified data can be made available to qualified researchers upon submitting a formal request, intent to use, and IRB approval or exemption to data access committee and first author. Approved users will be required to sign a data agreement (DUA) outlining data security and period of approval.

Sample

Eligibility criteria included being 18 years old or older, living in Miami-Dade, and self-identifying as a sexually active Latino male who has a son between the ages of 11 and 17 years old. Exclusion criteria included men planning to relocate within the follow-up period and men who did not identify as Latino or were not a father to a male adolescent. Participants also agreed to participate in two phone interviews for data collection and 6 months post-intervention follow-up calls. One hundred twenty-two (122) participants (i.e., fathers) were randomized into intervention and control groups using computer randomization. The intervention targeted only the fathers, hence, for the current analysis, only the fathers are included in the analysis.

Intervention

The HoMBReS peer advocate training is a CDC evidence-based intervention that was tested among Latino male farm workers and major adaptation was to include the father's mentorship role in the peer-advocate training. The male facilitator, a Latino staff member, was specially trained to dispel any myths about male sexual behavior, promote positive masculinity, and increase community awareness and accessibility of services related to substance abuse, HIV/AIDS, and family violence. The evidence-based Families Talking Together Intervention²⁶ and the CDC HoMBReS peer-advocate training^{23,42} served as models for the HoMBRES de Familia Intervention. The adapted intervention targeted community focus groups' identified risk factors in the community (i.e., cultural stressors such as HIV/AIDS stigma and machismo) and took advantage of key protective factors (i.e., familismo, respeto) associated with Latino culture. This study examined the effectiveness of group intervention programs tailored to the culture of fathers and sons living in South Florida's semi-rural community, as well as urban areas.

Amid the COVID-19 pandemic, one of the adaptations of the study's protocol was that it was successfully restructured into an interactive intervention using pre-recorded videos. Upon an agreed time, each session was sent via text to participants' smart phone or tablet. The interviewed men in the intervention group received a link for each of the four video-recorded sessions via smart phone text messages. The four (4) video sessions were an average of 1.5 h long and covered topics such as parental cultural influence on adolescents, HIV prevention (e.g., condom use) and the role of parents as educators (i.e., fathers), discussing talking sexual practice, alcohol and drug use prevention, and intimate-partner violence prevention (e.g., communication). Video sessions were recorded in Spanish by two bicultural bilingual post-doctoral-level facilitators who completed the baseline interviews of the study, had proven rapport with the participants, and were familiar with the community. At the three-month mark, participants were contacted by phone to increase retention and remind them of the six-month follow-up interview. This educational approach uses multimedia, specifically videos, to prompt participant reflection on sexual behavior and communication skills. Facilitators allowed time for participants to take notes, practice skills and formulate responses, and during the post intervention phone calls, activities were revisited to reinforce learning and clarity.

Control group

Participants assigned to the control group received a single 1.5-hour session via text upon an agreed time. The video session from the CDC Prevent2 Health promotion/Diabetes Prevention intervention program was facilitated by a post-doctorate level facilitator⁴³. The video session's content followed the CDC trainer's manual and focused on identifying, preventing, and managing type 2 diabetes. Fathers in the control group did not receive any information on the SAVA components. Like the intervention group, the facilitator was available during participants' viewing of the videos and provided a follow-up phone call to address major questions, overview of the session and offer referrals if needed. One of the protocol's adaptations was to successfully include interaction with the participants during the video-recorded sessions follow-up phone call. The fidelity of follow-up intervention sessions was supported through the training of facilitators and co-facilitators, the use of authorized intervention manuals, study standardized questions and de-briefing weekly sessions during the data collection and intervention phase of the study. Participants in the control group were made aware and offered the behavioral intervention once trial was completed.

Measures

Demographics

Participants reported age in years, education, household income in the last month, country of origin, living in urban or semi-rural areas only at baseline assessment. Given the short interval between the baseline and the six-month follow-up, we did not expect substantial changes in the demographics of the participants between the two assessments. Region/country of origin was created using the reported birth country, then we recorded the variable into six categories according to region/countries and the sample size represented: Venezuela, other South American countries, Central American countries, Caribbean, Mexico, and the United States. Living in either an urban or semi-rural area was created using the reported ZIP code of the participant's address.

Outcome measures

The Brief HIV Knowledge Questionnaire (HIV-KQ18), a validated and adapted version of the 18-item true/false response measure to assess individual knowledge about HIV transmission, and prevention was used. The questionnaire has shown internal consistency, stability, and sensitivity to the changes resulting from an intervention. In addition, it can be used with varying levels of education and literacy⁴⁴. We adapted the measure by selecting 14 true/false questions from the original scale to increase data homogeneity variance among other sample study groups in our lab. The scale score was calculated using the percentage of correct answers to the questions, ranging from 0 to 100%. A higher scale score shows a higher level of HIV knowledge. The reliability of the scale in the current study is 0.73.

HIV self-efficacy for STIs and HIV Scale was completed by participants. This is a 10-item tool to measure the level of confidence in the ability to practice STI and HIV prevention. The measure uses a 5-point Likert-type scale (1 = not sure at all to 5 = completely sure). We used nine items in the current study to increase data homogeneity variance among other sample study groups in our lab, and the final scale score was the summed score. A higher score represents higher self-efficacy for STI and HIV prevention⁴⁵. The reliability of the scale in the current study is 0.67.

Intimate partner violence (IPV) was measured using the Hurt, Insult, Threatened with harm, and Screamed (HITS) Tool for Intimate Partner Violence Screening, which is a 4-item screening tool to assess the frequency of intimate partner violence using a 5-point Likert-type scale (1 = Never to 5 = Frequently)⁴⁶. The scale measures IPV when the participant reports victimization. We then recoded the scale score into a dichotomous variable: the response is “Yes” if a participant experienced any intimate partner violence, otherwise the response is “No.” The tool has shown good reliability and validity in the English and the Spanish-speaking participants^{46,47}. In the current study, the reliability of the scale is 0.76.

Alcohol use was assessed using the Timeline Follow Back method. The Timeline Follow back is an assessment tool to measure substance use (alcohol, cigarette, marijuana, and other drugs). A 90-day calendar is used to help participants retrospectively to estimate their use⁴⁸. The measure was shown to have excellent comparability and a strong relationship between the measure and the symptoms of abuse/dependency⁴⁹. Daily alcohol consumption was measured in the number of standard drinks/days. We then calculated drinking frequency by summing up the total number of days that alcohol was consumed. Drinking quantity was calculated as the average number of standard drinks on days alcohol was consumed. Binge drinking was a binary variable that the response was “Yes” if five or more drinks were consumed per occasion.

Sexual risk behavior was a binary variable created using the following three variables. A response of “yes” was defined as any unprotected vaginal or anal sex, or reporting more than one sexual partner for vaginal or anal sex, in the last six months.

Statistical analysis

We examined descriptive statistics of the overall sample and by respective study group (intervention or control). The sample mean with standard deviation, median, and minimum and maximum were used to describe each continuous variable, while counts and percentages were used for each categorical variable. At each point, we compared the continuous variables by the study group variable with two-sample t-tests, and categorical variables by the study group with Chi-Square and Fisher’s exact tests. To assess the efficacy of the intervention, we applied linear regression for the changes in HIV knowledge and HIV self-efficacy. In the linear regression models, the change in each continuous outcome from pre- to post-intervention was the response variable. The changes were calculated using the post-interventional value subtracted from the pre-interventional value for each participant, so that a positive difference from pre- to post-intervention suggests an increase in the outcome, while a negative difference indicates a decrease in the outcome. In the linear regression models, the study group was the main independent variable, and we controlled the baseline values and demographics, including age at baseline, household income, education, living area, and region/country of origin. For the outcomes of drinking frequency and drinking quantity, we first performed linear regression for the change in the drinking outcomes from pre- to post-intervention, controlling for the baseline value. However, the linear regression assumptions were violated as the residuals were not normally distributed. We also tried the approach of transformation and standardization of the data for the drinking frequency and quantity, results show the linear regression assumption remained violated. Therefore, we conducted a repeated measures negative binomial model for drinking frequency and a repeated measures log-normal model for drinking quantity given the distribution of the two variables. In addition, we employed repeated measures logistic models for binge drinking and sexual risk behavior(s) because they are binary outcomes. Similarly, the study group was the main independent variable, and time of assessment and demographics were controlled for. Due to the low prevalence of IPV, we did not apply a further generalized linear mixed model to it. Moreover, we tested the interaction effect between the time of assessment and the study group in the models for binge drinking and sexual risk behavior(s). Non-significant interaction was removed from the final model; using 0.05 for the significance level. SAS (Statistical Analysis System) 9.4 was used for all the data analysis⁵⁰.

Results

Preliminary analyses

Demographics: The mean age of the sample was 43.5 years old (SD = 9.8) at baseline (Table 1). About half of the participants’ household income was \$2,000 or more (50%) and lived in the semi-rural area (57%). More than half of the Latino men had attended some college or had a college/university degree. The region or country of origin varied but most men were from Venezuelan origin (25%) and 18% ($n=22$) of the sample was from other South American countries. Individuals of Mexican origin represented 22% ($n=27$) of the sample, and individuals of Caribbean origin represented 9% ($n=11$), comprising individuals with roots including Cuba (4%, $n=5$) and

Variable	Overall				Study Group Intervention Control								p
	N	Mean (SD.)	Median	Min-Max	N	Mean (SD.)	Median	Min-Max	N	Mean (SD.)	Median	Min-Max	
	N	%	N	%	N	%	N	%	N	%	N	%	
Age at baseline (years)	122	43.5 (9.8)	44.0	18–66	61	42.5 (10.4)	43.0	18–64	61	44.4 (9.2)	44.0	18–66	0.275
Variable													p
	122	100.0			61		50.0		61		50.0		
Household income last month													0.767
\$2000 or more	60		50.0		31		52.5		29		47.5		
\$1000-\$1999	41		34.2		20		33.9		21		34.4		
0-\$999	19		15.8		8		13.6		11		18.0		
Education													0.571
College/university degree	36		29.5		16		26.2		20		32.8		
Some college	29		23.8		14		23.0		15		24.6		
High school or GED	24		19.7		15		24.6		9		14.8		
Less than high school	33		27.0		16		26.2		17		27.9		
Region/Country of Origin													0.010
Venezuela	31		25.4		13		21.3		18		29.5		
U.S.	15		12.3		11		18.0		4		6.6		
Other South American Countries	22		18.0		7		11.5		15		24.6		
Mexico	27		22.1		10		16.4		17		27.9		
Central American Countries	16		13.1		12		19.7		4		6.6		
Caribbean	11		9.0		8		13.1		3		4.9		
Living area													0.855
Urban	53		43.4		27		44.3		26		42.6		
Semi-rural	69		56.6		34		55.7		35		57.4		

Table 1. Participant demographics at baseline. Note. SD.=standard deviation. p values were from two-sample t-test for age by the study groups, while were from Chi-square/Fisher's exact tests for other variables by the study groups.

Dominican Republic (5%, $n=6$). Only about 12% ($n=15$) of the participants reported their region/country of origin was the United States. There was no statistically significant difference in the demographic variables between the two study groups (intervention and control), except for the region/country of origin ($p=.01$). The intervention group had more participants who were born in the U.S., Central America, or the Caribbean, whereas the control group had a greater number of participants born in Mexico, Venezuela, or other South American countries (Table 1). There were no significant baseline differences between the groups' demographics or other outcomes. There were no adverse events reported in either group.

Main analyses: primary outcomes

HIV knowledge

The mean correct response rate was increased from baseline (Mean = 65%, SD = 20%) to the 6-month follow-up (Mean = 81%, SD = 20%, Table 2) in the intervention group. Specifically, the correct response rate in the intervention group and the control group were both 65% at baseline ($p>.05$). However, it was increased to 81% in the intervention group and 69% in the control group at the 6-month follow-up ($p=.0007$). The mean increase in HIV knowledge from baseline to follow-up was significantly higher in the intervention group ($p=.0005$), with the correct response rate increased by 20% (SD = 20%) in the intervention group compared to 4% (SD = 20%) for the control group. Results from the linear regression model suggest that, on average, the increase in HIV knowledge from baseline to post-intervention was significantly higher in the intervention group than the control group by 14% ($\beta = 0.14$, 95% CI: [0.08, 0.2], $p < .0001$, Table 3), controlling for baseline HIV knowledge level and demographics. In addition, participants' baseline HIV-knowledge was significantly associated with the change in HIV knowledge from baseline to post-intervention (Table 3). A higher baseline HIV knowledge level was associated with a reduction in the increase of HIV knowledge from baseline to the 6-month follow-up ($b = -0.56$, 95% CI: [-0.72, -0.4], $p < .0001$). Overall, education significantly predicted HIV knowledge (Table 3). Compared to participants with education of less than high school, those who attended some college ($\beta = 0.12$, 95% CI: [0.03, 0.22], $p = .013$) had a significantly higher increase in the level of HIV knowledge.

HIV self-efficacy

There was no significant difference in HIV self-efficacy between the two study groups at baseline ($p > .05$, Table 2), whereas the HIV self-efficacy was significantly higher in the intervention group at the 6-month follow up ($p = .044$). At baseline, the mean HIV self-efficacy was 38.3 (SD = 5.1) in the intervention group and 38.8 (SD = 6.1) in the control group ($p > .05$). The mean HIV self-efficacy was increased to 40.2 (SD = 3.7) in the intervention group and became lower in the control group at the follow-up (38.5, SD = 5.4). The change in HIV

Variable	Overall			Research Arm						p
				Intervention			Control			
	N	Mean (SD.)	Min-Max	N	Mean (SD.)	Min-Max	N	Mean (SD.)	Min-Max	
HIV knowledge at baseline	122	0.6 (0.2)	0.1-1	61	0.6 (0.2)	0.1-1	61	0.6 (0.2)	0.1-1	0.896
HIV knowledge at follow up	120	0.7 (0.2)	0.1-1	59	0.8 (0.2)	0.4-1	61	0.7 (0.2)	0.1-1	0.001
Change in HIV knowledge	120	0.1 (0.2)	-0.4-0.7	59	0.2 (0.2)	-0.4-0.6	61	0.04 (0.2)	-0.3-0.7	0.001
HIV self-efficacy at baseline	122	38.6 (5.6)	16-45	61	38.3 (5.1)	23-45	61	38.8 (6.1)	16-45	0.619
HIV self-efficacy at follow up	120	39.3 (4.7)	22-45	59	40.2 (3.7)	27-45	61	38.5 (5.4)	22-45	0.044
Change in HIV self-efficacy	120	0.8 (5.6)	-18-22	29	2 (5.2)	-8-15	61	-0.4 (5.8)	-18-22	0.022
Drinking frequency at baseline	122	7.7 (13.7)	0-90	61	8.6 (15.3)	0-90	61	6.7 (12)	0-58	0.453
Drinking frequency at follow up	120	9.8 (17.5)	0-90	59	11.1 (20.2)	0-90	61	8.5 (14.4)	0-90	0.418
Change in drinking frequency	120	2.0 (15.9)	-64-84	59	2.2 (17.10)	-64-81	61	1.8 (14.8)	-47-84	0.878
Drinking quantity at baseline	122	2.6 (2.8)	0-14	61	2.8 (3.1)	0-14	61	2.3 (2.4)	0-11.4	0.351
Drinking quantity at follow up	120	3 (3.6)	0-25.4	59	2.9 (3.2)	0-15.8	61	3.1 (4)	0-25.4	0.800
Change in drinking quantity	120	0.3 (2.8)	-5.9-24.4	59	0 (2.1)	-5.9-6.1	61	0.7 (3.2)	-5-20.4	0.141
Variable	N	%		N	%		N	%		p
Total number of participants	122	100.0		61	50.0		61	50.0		
Binge drinking at baseline	44	36.1		25	41.0		19	31.1		0.258
Binge drinking at follow up	46	38.3		21	35.6		25	41.0		0.544
Intimate partner violence at baseline	19	15.6		10	16.4		9	14.8		0.803
Intimate partner violence at follow up	15	12.5		10	16.9		5	8.2		0.147
Sexual risk behavior(s) at baseline	80	67.8		42	72.4		38	63.3		0.291
Sexual risk behavior(s) at follow up	91	78.4		38	69.1		53	86.9		0.020

Table 2. Descriptive statistics of the primary outcomes in the adult Latinx men at baseline and the six-month follow up. Note. SD.= standard deviation. p values were from two-sample t tests for continuous outcomes and were from Chi-square tests for categorical outcomes.

Variable	Estimate [95% CI]	
	HIV Knowledge	HIV Self Efficacy
Group: Intervention vs. Control	0.14 [0.08, 0.2]***	2.1 [0.48, 3.72]*
Baseline value of the outcome	-0.56 [-0.72, -0.4]***	-0.71 [-0.86, -0.56]***
Age at baseline (in years)	0.01 [-0.01, 0.01]	-0.02 [-0.1, 0.07]
Household Income		
\$1,000-\$1,999 vs. 0-\$999	0.02 [-0.06, 0.11]	-0.66 [-3.02, 1.69]
\$2,000 or more vs. 0-\$999	0.04 [-0.05, 0.12]	0.17 [-2.2, 2.53]
Education		
High school or GED vs. Less than high school	0.02 [-0.07, 0.11]	2.85 [0.43, 5.28]*
Some college vs. Less than high school	0.12 [0.03, 0.22]*	1.29 [-1.31, 3.89]
College/university degree vs. Less than high school	0.03 [-0.08, 0.13]	1.6 [-1.35, 4.55]
Living in: Urban vs. Semi-rural	0.08 [-0.02, 0.17]	1.63 [-0.85, 4.11]
Region/Country of Origin		
Other South America vs. Venezuela	-0.06 [-0.16, 0.04]	1.5 [-1.25, 4.25]
Central America vs. Venezuela	-0.01 [-0.13, 0.11]	0.59 [-2.54, 3.72]
Mexico vs. Venezuela	0.08 [-0.04, 0.19]	0.53 [-2.59, 3.64]
U.S. vs. Venezuela	-0.1 [-0.23, 0.04]	-0.35 [-3.97, 3.26]
Caribbean vs. Venezuela	-0.1 [-0.22, 0.02]	-1.3 [-4.51, 1.92]

Table 3. Results from linear regression for changes in HIV knowledge and self-efficacy from baseline to post-intervention (N=118). Note. a. The reference groups were "0-\$999" for household income, "Less than high school" for education, "Semi-rural" for the living area, "Venezuela" for country/region of origin, and "control" for the study group. *p<.5, **p<.01, ***p<.001.

self-efficacy was significantly different in the two study groups from baseline to follow-up ($p=.022$): there was a mean increase of 2 (SD=5.2) in the intervention group, while there was a mean decrease of 0.4 (SD=5.8) in the control group. Consistently, results from regression analysis indicate that the intervention group had a significant higher increase in HIV self-efficacy than the control group ($\beta=2.1$, 95% CI: [0.48, 3.72], $p=.012$,

Table 3), adjusting for the baseline HIV self-efficacy and demographics. The baseline level of HIV self-efficacy was significantly associated with the change in the outcome, that one unit higher in the baseline HIV self-efficacy was associated with a 0.71 reduction in the change of it from the baseline to the follow-up ($b = -0.71$, 95% CI: [-0.86, -0.56], $p < .0001$), adjusting other variables in the model. Education significantly predicted the change in HIV self-efficacy ($p < .05$, Table 3). On average, compared to participants who had education of less than high school, those with high school or GED had a higher HIV self-efficacy level by 2.85 ($\beta = 2.85$, 95% CI: [0.43, 5.28], $p = .02$).

Intimate-partner violence (IPV)

There was no significant difference in IPV between the two study groups at baseline and follow-up ($p > .05$, Table 2). A total of 19 Latino men (16%) reported IPV at baseline (Table 2), while 15 (13%) reported IPV at follow-up ($p > .05$).

Alcohol use

At baseline, the mean drinking frequency was 7.7 days ($SD = 13.7$, Table 2) for the study sample (Table 2) and the median drinking frequency was 3.5 days, while the mean was 9.8 days ($SD = 17.5$) and median drinking frequency was 4 days at the follow-up ($p > .05$). There was no significant difference in the drinking frequency in the two study groups at either baseline or the follow-up ($p > .05$, Table 2). There was also no significant association between the other predictors in the mixed model and drinking frequency. At baseline, the mean drinking quantity was 2.8 ($SD = 3.1$) among the intervention group and 2.4 ($SD = 2.4$) in the control group. At the follow-up assessment, drinking quantity increased to 2.9 ($SD = 3.2$) in the intervention group and 3.1 ($SD = 4.0$) in the control group. Results from the generalized mixed model suggest that the drinking quantity increased by 70% at the follow-up for the entire study sample ($\beta = 1.71$, 95% CI: [1.48, 2.07], $p < .001$, Table 4). Although no significant difference was found in the study group's main effect, there was a significant interaction between the assessment time and the study group (Fig. 2). 36.1% of the participants reported binge drinking at baseline, while 38.3% reported it at the follow-up ($p > .05$). There was no significant difference in binge drinking by the study

Variable	Estimate [95% CI]			
	Drinking frequency ^a	Drinking Quantity ^b	Binge Drinking (Yes/No) ^c	Sexual Risk Behavior(s) (Yes/No) ^c
Age at baseline (in years)	1.01 [0.97, 1.06]	0.99 [0.97, 1.01]	1.04 [0.93, 1.15]	0.98 [0.94, 1.01]
Household Income				
\$1,000-\$1,999 vs. 0-\$999	0.30 [0.09, 1.01]	0.64 [0.35, 1.18]	2.58 [0.15, 45.60]	1.15 [0.45, 2.94]
\$2,000 or more vs. 0-\$999	0.53 [0.17, 1.62]	0.68 [0.37, 1.24]	3.77 [0.20, 70.03]	0.81 [0.31, 2.09]
Education				
High school or GED vs. Less than high school	1.00 [0.29, 3.43]	1.09 [0.57, 2.06]	0.69 [0.04, 12.91]	1.12 [0.45, 2.78]
Some college vs. Less than high school	0.73 [0.20, 2.60]	0.88 [0.45, 1.71]	1.94 [0.09, 41.91]	1.10 [0.408, 2.964]
College/university degree vs. Less than high school	0.68 [0.17, 2.72]	1.02 [0.50, 2.12]	0.33 [0.01, 9.24]	0.83 [0.26, 2.62]
Living in: Urban vs. Semi-rural	3.54 [1.01, 12.37]	1.28 [0.67, 2.46]	0.46 [0.023, 9.32]	4.05 [1.40, 11.66] [*]
Region/country of origin				
Mexico vs. Venezuela	1.02 [0.21, 4.84]	0.53 [0.24, 1.19]	2.77 [0.06, 123.81]	0.76 [0.19, 2.97]
Other South America vs. Venezuela	0.73 [0.19, 2.83]	0.81 [0.40, 1.61]	1.47 [0.05, 41.07]	0.81 [0.23, 2.84]
Central America vs. Venezuela	0.43 [0.09, 2.08]	0.81 [0.37, 1.78]	1.16 [0.03, 50.32]	1.03 [0.25, 4.29]
Caribbean vs. Venezuela	0.49 [0.10, 2.42]	0.62 [0.27, 1.44]	0.71 [0.02, 26.40]	0.55 [0.14, 2.12]
U.S. vs. Venezuela	1.02 [0.16, 6.36]	0.83 [0.33, 2.10]	1.14 [0.01, 93.62]	1.14 [0.25, 5.24]
Time: 6 months follow up vs. Baseline	1.24 [0.97, 1.59]	1.71 [1.42, 2.07] ***	0.71 [0.29, 1.73]	1.79 [0.97, 3.32]
Group: Intervention vs. Control	1.34 [0.59, 3.06]	1.46 [0.92, 2.32]	0.80 [0.11, 5.78]	0.71 [0.37, 1.36]
Time*Group		0.59 [0.46, 0.75] ***		

Table 4. Results from generalized linear mixed models for alcohol use and sexual risk related outcomes ($N = 238$). Note. a. Estimates for the model predicting the drinking frequency were adjusted risk ratios. b. Estimates for the model predicting drinking quantity were exponentiated correlation coefficients. c. Estimates for models predicting binge drinking, and sexual risk behaviors (Yes/No) were adjusted odds ratios. d. The reference groups were "0-\$999" for household income, "Less than high school" for education, "Semi-rural" for the living area, "Venezuela" for country/region of origin, "baseline" for the time variable, and "control" for the study group. e. Demographic variables, including age, household income, education, living area, country of origin, as well as the study group (intervention or control) were time invariant variables that baseline values were used in the analysis. Other covariates and the outcome variables were time-varying variables assessed at both the baseline and the 6-month follow-up. f. The $n = 238$ displayed in the table corresponds to the number of data records used in the model, not the number of participants. The 238 records include the pre- and post-data from the 122 participants. 2 records were lost to follow-up, and 4 records with missingness in the used variables. Therefore, the final n for the generalized linear mixed models was 238. * $p < .5$, ** $p < .01$, *** $p < .001$.

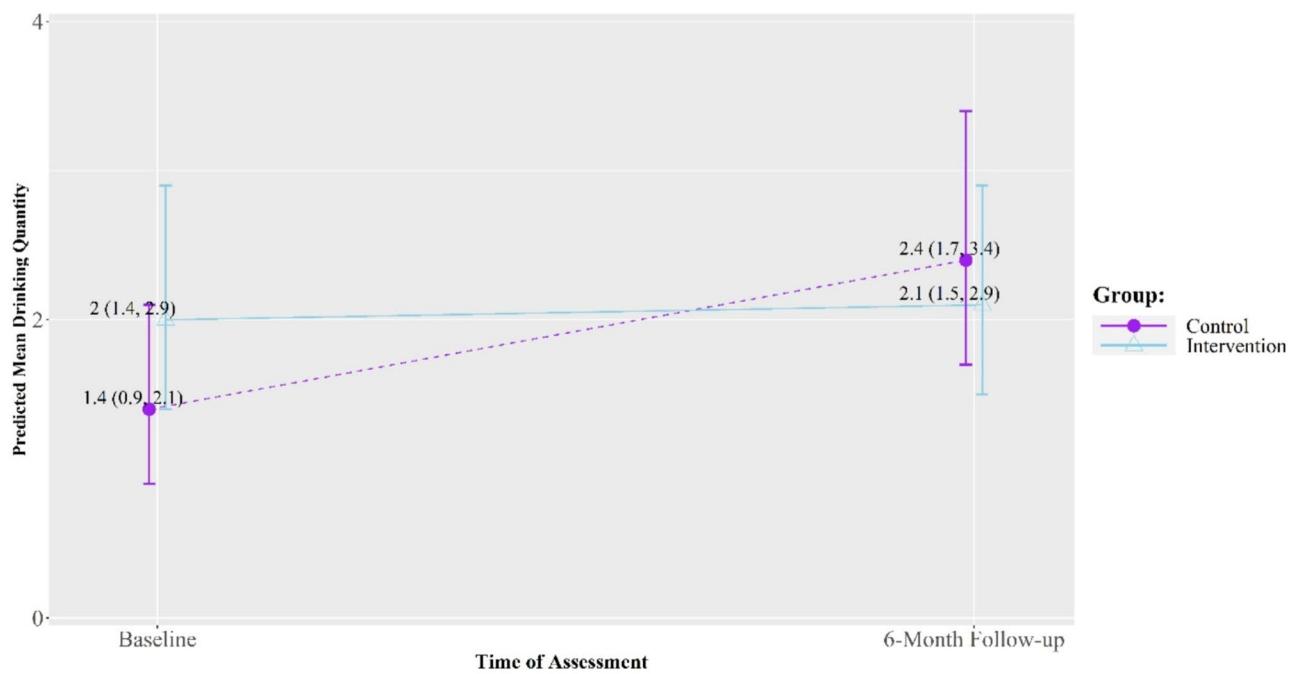


Fig. 2. Predicted mean with 95% confidence interval of drinking quantity by study groups.

group at either baseline or the follow-up ($p>.05$). Results from the generalized linear mixed model show that there was no significant association between any of the predictors and binge drinking ($p>.05$).

Sexual risk behavior

At baseline, 68% of the participants reported sexual risk behaviors compared to 78% at the 6-month follow-up ($p>.05$, Table 2). There was no significant difference in sexual risk behavior at baseline between the two study groups ($p>.05$). However, results from the exploratory analysis show a significant difference in sexual risk behavior at follow-up; that is, the control group reported a higher proportion of sexual risk behavior than the intervention group (69% vs. 87%). Results from the general linear mixed model suggest that participants living in the urban area were more likely to have sexual risk behavior than those living in the semi-rural area (aOR = 4.05, 95% CI: [1.4, 11.7], $p=.01$, Table 4); other demographic variables were not significantly associated with sexual risk behaviors ($p>.05$).

Discussion

This study implemented an adapted intervention to mitigate the synergistic challenges of substance abuse, violence, and HIV/AIDS, collectively referred as SAVA-syndemic among Latino men residing in both urban and semi-rural settings. Baseline analysis showed no difference in HIV knowledge between the intervention and the control group, nonetheless, the significant increase in the intervention group at follow-up showed the effectiveness of the remote intervention in improving participants' HIV prevention knowledge. As reported in other studies, the culturally appropriate video adaptation of HIV and risky sexual behavior prevention interventions can be effective among Latinos³⁸. Results from the current study underscore the importance of innovative approaches to health education that maintain cultural relevance and participant engagement. By increasing self-efficacy and providing culturally sensitive content, these types of interactive adapted video interventions can significantly reduce health disparities among Latino men.

Results suggest the effectiveness of the intervention on HIV prevention self-efficacy (Table 3). Like other studies, formal education was significantly associated with HIV prevention self-efficacy^{51,52}. Self-efficacy can significantly affect the AIDS infection rate among Latinos in Miami Dade as men are an important infection vector advancing the high rates of seropositive HIV among women⁵³. The modest results of the current study highlight that culturally tailored video interventions are associated with improved health outcomes among Latino participants. These videos were particularly effective in conveying complex health information in an accessible and relatable manner, which is crucial for increasing self-efficacy and promoting lasting behavior change.

Alcohol use frequency did not significantly change among participants, while the quantity of drinks increased significantly in the six month follow up. This unexpected increase in alcohol quantity in both groups may have been a response to COVID-19 related stress reported in prior studies; our interpretation is supported by the finding of several studies highlighting the negative effects of the pandemic on mental health and substance abuse^{45,54,55}. Notably, drinking was found to increase 60% by participants who reported being more anxious about the pandemic⁵⁴. Participants in our study reported higher anxiety levels during the follow-up interview, as reported by other studies; there were higher levels of stress and anxiety, which may have led to increased drinking

as a coping mechanism⁵⁵. The pandemic worsened multiple stressors among underserved populations (loss of employment, lack of income, domestic violence); participants who reported higher drinking quantity at follow-up, as reported by other studies, may be in response to the pandemic stress effect^{54,56}. Although the number of alcohol drinks increased at the follow-up, binge drinking did not significantly increase, which suggests that the increase in alcohol consumption may have also been a consequence of boredom and staying at home during lockdown⁵⁶.

Results from this study suggest that the HoMBRES de Familia intervention was effective in increasing HIV knowledge and HIV prevention and decreasing risky sexual behaviors. The non-statistically significant increase of self-efficacy among participants may suggest that during an isolated and stressful historical event such as the quarantine of COVID-19 pandemic, men were more likely to have sex with their main partners only. Thus, they were less likely to use condoms⁵⁷. Additionally, the increased risk of using higher quantities of alcohol may have impacted condom use self-efficacy among men with problematic drinking, those who may have previously had them or were at risk of increased alcohol use. Future retrospective studies addressing COVID-19's impact on Latino health and engagement in health risk behaviors, as well as larger longitudinal prospective studies may provide a more nuanced understanding of these associations.

Although results from the current study are promising, there are several limitations worth noting, such as the self-report data, the phone interviews rather than face-to-face interviews, and the video sessions rather than in-person group sessions. Despite these limitations, research shows the reliability of self-reported data and culturally appropriate video interventions for Latino men³⁷. It is important to note as one limitation of the current study, the imbalance in attention between the control and intervention arms as this may have influenced the outcomes and need to be considered when interpreting the results⁵⁸. Thus, to decrease limitations such as participants' attention and skill building, one of the adaptations of the intervention was to follow video viewing sessions with phone calls to answer all participants' questions and highlight the main themes of the session. During the follow-up calls, participants were eager to ask questions and talk about stigmatized subjects such as intimate-partner violence when they were by themselves rather than in a group. Moreover, participants reported being highly satisfied with having the flexibility of watching the video at their own convenience, particularly because most of these men work long hours in agriculture, construction or Uber/cab drivers. The decision to focus on condom use, rather than including the use and knowledge of PrEP, posed a limitation to the generalizability of the study; This decision was based on our community based knowledge considerations and the cultural adaptation feedback received from focus groups with community leaders. As a community-based intervention for Latino men rather than men who have sex with men (MSM), we prioritized the use of readily available, inexpensive, and tangible actions that individuals could directly control during sexual encounters to protect themselves. To address the limitation of excluding MSM, we controlled for sexual activity with men in order to account for potential differences in risk behaviors and prevention strategies.

Although this intervention was adapted due to the imposed pandemic social distancing, this study highlights how video interventions, when tailored to the cultural and linguistic needs of Latinos, can enhance engagement and improve outcomes in HIV prevention programs³⁷. Future interventions for this community may focus on remote/online group interventions facilitated via online video conferencing platforms (e.g., Zoom or Google Meet) that allow synchronous participation of individuals. The current study underscores the crucial role of remote mobile health interventions that emerged during the pandemic, its role in increasing accessibility, acceptability and its potential to be used as a major tool in delivering culturally tailored health intervention and promoting behavior change.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Author contributions

P.R.* (E-mail: proja003@fiu.edu) developed the study design and method and conceptualized the study. W.W. analyzed the data and produced the first draft of the results section. P.R., O.N., Y.C.T., and B.C. performed the literature review and wrote the introduction section. P.R., M.K., G.R., and J.C.B. were involved in the implementation of the longitudinal parent study and the method section of the manuscript. P.R. and v.B. were involved in the overseeing of the project. M.P., Y.C.T., J.C., and M.R. revised the introduction and discussion sections and finalized the manuscript. All authors reviewed the study design and methods and edited the article. All authors approved this version of the article. None of the authors have any conflict of interest to declare.

Declarations

Competing interests

The authors declare no competing interests.

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