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ORIGINAL RESEARCH

Infectious Disease

Comparison of a video to a pictorial brochure in improving HIV/AIDS and HIV testing knowledge and increasing HIV testing motivation and behavioral skills among adult emergency department patients

Roland C. Merchant MD, MPH, ScD[1] | Sarah J. Marks MS[1] | Melissa A. Clark PhD[2] | Michael P. Carey PhD[3] | Tao Liu PhD[4]

[1]Department of Emergency Medicine, Brigham and Women's Hospital, Harvard Medical School, Boston, Massachusetts

[2]Department of Health Services Policy and Practice, School of Public Health, and Department of Obstetrics and Gynecology, Alpert Medical School, Brown University, Providence, Rhode Island

[3]Centers for Behavioral and Preventive Medicine, The Miriam Hospital, Department of Behavioral and Social Sciences, School of Public Health, and Department of Psychiatry and Human Behavior, Alpert Medical School, Brown University, Providence, Rhode Island

[4]Department of Biostatistics, Center for Statistical Sciences, School of Public Health, Brown University, Providence, Rhode Island

Correspondence
Roland C. Merchant, MD, Department of Emergency Medicine, Brigham and Women's Hospital, 75 Francis Street, Boston, MA 02115, USA.
Email: rmerchant@bwh.harvard.edu

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Abstract

Objectives: We sought to determine if a pictorial brochure improves HIV/AIDS and HIV testing knowledge and increases HIV testing motivation and behavioral skills as well as a video among adult emergency department patients, regardless of language spoken and health literacy level.

Methods: ED patients were stratified by primary language spoken (English or Spanish) and health literacy level (lower or higher) and randomly assigned to watch the study video or review the content-matched pictorial brochure. HIV/AIDS and HIV testing knowledge, motivation for HIV testing, and behavioral skills for HIV testing were assessed using study instruments before and after watching the video or reviewing the pictorial brochure.

Results: Of the 712 English- and 655 Spanish-speaking ED patients, HIV/AIDS and HIV testing knowledge improved more among participants in the video than the pictorial brochure arm (Δ 0.43; 95% confidence interval [CI]: 0.07, 0.79). This improvement was more pronounced among those with lower (Δ 0.60; 95% CI: 0.06, 1.13) than higher health literacy (Δ 0.27; 95% CI: −0.22, 0.76). HIV testing motivation was high before the intervention and did not increase differentially between arms. Confidence in recognizing when to be tested for HIV was slightly greater in the video than pictorial brochure arm (Δ 0.15; 95% CI: 0.01, 0.28), but did not differ by language spoken or health literacy level.

Conclusions: A video improved HIV/AIDS and HIV testing knowledge slightly more than a pictorial brochure. Other considerations (eg, patient volume, staffing, space, and video access) should guide EDs on how best to provide information about HIV testing to ED patients.

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1 | INTRODUCTION

1.1 | Background

The Centers for Disease Control and Prevention (CDC) recommend that all patients at every HIV testing encounter receive information about HIV/AIDS and HIV testing orally or in writing.[1] Providing HIV/AIDS and HIV testing information remains necessary, as revealed by our prior research showing poor baseline knowledge on this topic among adult emergency department patients.[2] However, delivering information about HIV/AIDS and HIV testing in person in the ED for all HIV testing encounters is limited by multiple practical constraints, including staff expertise and availability to provide this information.

Written brochures are a practical alternative to delivering information in person orally but might not be useful for those with lower health literacy, especially when the content is presented in a text-only form.[3–6] Furthermore, there are few studies demonstrating the value of written brochures with respect to improving knowledge about HIV/AIDS and HIV testing, and no studies have been performed in the ED.[7,8] Videos might be as, or perhaps more, efficacious as orally delivered HIV/AIDS and HIV testing information in EDs,[9–13] particularly for those with lower health literacy. However, the equipment, expense, and time required to show videos can limit their use in busy EDs and also might contain too much information, which might be off-putting for those with strong baseline knowledge of the topic.

The use of pictorial brochures, similar to a comic book or a graphic novella, might be a promising yet untested alternative. Because pictorial brochures use images to enhance understanding of written materials, they might be better than text-only brochures for lower health literacy patients.[14] They also can be reviewed quickly and allow the reader to concentrate on new information. However, pictorial brochures still require basic reading abilities and are of unknown efficacy in providing HIV/AIDS and HIV testing information in the ED, especially for the estimated 40% of ED patients with lower health literacy.[15]

1.2 | Importance

Having a variety of efficacious and practical modes of delivering HIV/AIDS and HIV testing information can reduce barriers to ED HIV testing. Having multiple health communication modes may enable ED staff to select those that match patient needs and maintain ED operational efficiency. We previously developed and tested an animated and live-action short video ("What do you know about HIV and HIV testing?") based on the information-motivation-behavioral skills model[16,17] that addresses CDC-recommended HIV/AIDS and HIV testing information components.[18,19] We found in a randomized, controlled trial that the video performed as well as comparable information delivered orally by an HIV test counselor.

Although we have demonstrated that the video can improve HIV/AIDS and HIV testing knowledge as adequately as orally delivered information,[13] the improvement might not be sufficient to enact HIV-related behavior change.[20] We previously did not evaluate if the video increases motivation to undergo HIV testing and improves behavioral skills around HIV testing. If the video increases HIV testing motivation and behavioral skills, it might be used to encourage patients to be tested for HIV in the ED and seek testing in the future. We also have not yet determined if the comparable pictorial brochures can be a substitute for the video. Further, we do not yet know if the pictorial brochures are acceptable alternatives for patients with lower health literacy.

If the pictorial brochure is as efficacious as the video, it can offer a lower cost, lower technology solution for busy EDs, and might be a quicker way for some patients to be better informed about HIV testing. However, if the pictorial brochure is not helpful for lower health literacy patients, accommodation for providing the video should be considered. Providing patients with a choice to watch the video or review the pictorial brochure might also increase their engagement in this process, which could affect improvement in knowledge, motivation, and behavioral skills.

The Bottom Line

Effective and practical educational tools are necessary for patients to understand HIV/AIDS and HIV testing. This randomized trial of 1367 English- and Spanish-speaking patients in four geographically distinct EDs shows that video improved HIV testing knowledge slightly more than a pictorial brochure, although both are potentially valuable for delivering this information.

1.3 | Goals of the investigation

In this randomized, controlled trial among adult ED patients, we compared immediate improvements in HIV/AIDS and HIV testing knowledge and HIV testing motivation and behavioral skills between those who watched the video versus those who reviewed the pictorial brochure. We aimed to determine if either the pictorial brochures or the videos could be used, regardless of language spoken or health literacy level, or if one delivery mode outperforms the other. We also explored whether participant-stated choice for a video or pictorial brochure changed after random assignment, and if their preferences affected improvement in HIV/AIDS and HIV testing knowledge and HIV testing motivation and behavioral skills.

2 | METHODS

2.1 | Study design and setting

This randomized, controlled trial recruited adult English- or Spanish-speaking patients at four geographically distinct, urban EDs from April 2015 to December 2018. Spanish-speaking participants were

recruited at EDs in California and Rhode Island (average annual adult patient volumes of 70,000 and 115,000, respectively). English speakers were recruited from EDs in Alabama and Ohio (average annual adult patient volumes of 60,000 and 75,000, respectively). The institutional review boards at the four hospitals approved the study. The study protocol, questionnaires and detailed descriptions of the video content have been published previously.[21] The investigation also involved a subsequent 1-year longitudinal study among ED patients whose HIV test was negative. However, only the results of the in-ED portion of the study are provided in this report.

2.2 | Study sample

Research assistants at the four EDs recruited participants 7 days/week on rotating shifts. Across the four EDs, 69% of the shifts occurred 7 am to 3 pm, 28% occurred 3 pm to 11 pm, and 3% occurred from 11 pm to 7 am. Using an online, random number generator (www.random.org), research assistants selected a random sample of adult patients present in the ED during data collection periods according to their bed numbers and locations in the ED. They reviewed these randomly selected patients' electronic medical records to screen for initial study eligibility. They would then briefly interview potentially study-eligible patients to confirm their eligibility. For study-eligible patients, the research assistants assessed health literacy using the Short Assessment of Health Literacy-Spanish and English (SAHL-S&E), for which lower health literacy is defined as a score of 14 or less on an 18-point scale.[22] Participants were enrolled to satisfy a quota specified by language spoken (English or Spanish) and health literacy level (lower or higher). The a priori quota was: English speakers, lower health literacy (n = 300); English speakers, higher health literacy (*n* = 300); Spanish speakers, lower health literacy (n = 300); and Spanish speakers, higher health literacy (n = 300). Additional participants above these quotas were enrolled to mitigate loss to follow-up for the 1-year longitudinal study. Participants were informed during study enrollment that they would be offered rapid HIV testing after watching the video or reviewing the pictorial brochure. Verbal consent was obtained for portion of the study reported in this manuscript.

ED patients randomly selected for study inclusion and who met study quota were study eligible if they were 18–64 years old; English- or Spanish-speaking; not critically ill or injured; not prison inmates, under arrest, nor undergoing home confinement; not presenting for an acute psychiatric illness; not intoxicated; and did not have a physical or cognitive impairment that prevented them from providing consent or participating in the study. ED patients who were excluded included those who were already known to be HIV infected, on pre-exposure prophylaxis, or in HIV vaccine studies, would not be remaining in the United States for the subsequent year, could not provide a method of reaching them after enrollment, or were unable to read at a second grade level in English or Spanish per the IPTII Spanish or English Oral Test (Ballard & Tighe Publishers, Brea, CA). For Spanish speakers only, Spanish had to be their primary language, which was verified using the screening tool by Karliner et al.[23]

2.3 | Intervention arms: video and pictorial brochure

"What do you know about HIV and HIV testing?"[24] is a 15-minute animated and live-action video that contains CDC-recommended HIV and HIV testing information,[25] as well as information about acute HIV infection and current methods of HIV testing (eg, rapid and conventional, oral, fingerstick and phlebotomy sampling, and antibody, antigen, and ribonucleic acid testing). The video is available in English and Spanish (http://biomed.brown.edu/hiv-testing-video, https://merchant.bwh.harvard.edu/hiv-testing-videos/). The content of the video[21] is grounded in the information-motivation-behavioral skills model[16,17] with a primary emphasis on improving knowledge about HIV/AIDS and HIV testing, while also increasing motivation for testing and improving behavioral skills regarding HIV testing. The voice-over narrated video follows two protagonists (male and female, purposely racially/ethnically ambiguous and not named to appeal to a wider audience and avoid social labels) as they receive information about HIV/AIDS and HIV testing and proceed through the HIV testing process. Animation, graphics, images, still shots, text, and live-action segments emphasize the topics presented. The Fernandez-Huerta Readability Score[26] for the Spanish-language version of script for the video is 85, which indicates an "easy" level of reading difficulty. The final English-language version of the video script has a Flesch reading ease of 72.9, indicating a low reading ability level (appropriate for 11-year-olds).

The HIV/AIDS and HIV testing pictorial brochure is a compact printed version of the video. It contains identical information as the video, except there is no voice-over narration, music, animation, or live-action segments. Instead, graphics, images, and still shots of selected components of the animated and live-action segments are depicted. The Fernandez-Huerta Readability Score[26] and the Flesch reading ease for the pictorial brochure are identical to the video.

2.4 | Study procedures and assessments

Participants were randomly assigned, on enrollment, to the video or pictorial brochure arm as stratified by language and health literacy level, using a centralized randomization center (http://www.randomize.net, Interrand, Ottawa, Canada). Participants were queried by the research assistants about their demographic characteristics and HIV testing history. Before receiving their intervention (video or pictorial brochure), they completed the baseline measures assessing their HIV/AIDS and HIV testing knowledge (25 items) and HIV testing motivation (3 items) and behavioral skills (6 items). The HIV/AIDS and HIV testing knowledge questionnaire[21] (Cronbach's α for this sample = 0.80) was developed through a rigorous series of pilot testing and cognitive-based assessments and includes five domains:

definition and nature of HIV/AIDS, HIV prevention, HIV transmission, HIV testing methods, and meaning of HIV test results. Scores are based on correct responses (range: 0–25 points, none correct to all correct). The three HIV testing motivation items were adapted from our prior work on this topic,[27,28] and responses were on a 5-point numeric and word scale. The six behavioral skills items were created for this investigation; responses to the three about confidence in skills were on a 5-point numeric and word scale, whereas the other three scored as correct or incorrect responses.[21] The questionnaires were presented to participants using an audio, computer-assisted self-interviewer (ACASI), which displayed the questions on the tablet computer while a recording read the questions to them. Next, they either watched the video on a tablet computer using headphones or reviewed the pictorial brochure, per their random assignment. Immediately afterward, they repeated completing the HIV/AIDS and HIV testing knowledge and HIV testing motivation and behavioral skills assessment instruments.

2.5 | Sample and effect sizes

We calculated the study sample needed to be n = 1200, with equal size strata (n = 150) by language, health literacy level, and information delivery mode (ie, $2 \times 2 \times 2 = 8$ total strata). This sample size was based for the primary outcome of an estimated difference in scores on the HIV/AIDS and HIV testing knowledge questionnaire between the video and pictorial brochure arms. Based on our prior video studies,[2,9,24] we assumed that the scores (range: 0–25 points) on the 25-item questionnaire would have a normal distribution with an SD of ~3. Before information delivery, total mean scores of the knowledge questionnaire for the two arms were assumed to be the same (because of random assignment) for participants of the same language and health literacy level. Short-term (after vs before assessment in ED) within-person correlation was assumed to be 0.7 or higher.[24] We hypothesized that the pictorial brochure would improve knowledge by an average of 2 points, while the video would improve the knowledge by an average of 3.5 points (difference in scores between study arms: $\Delta = 3.5 - 2 = 1.5$), based on our prior research. In the absence of a known clinical standard or reference, we used a difference of 1.5 points as a minimum difference effect size between the video and pictorial brochure study arms. We recruited sample sizes that would be sufficient to calculate the difference in total mean scores between study arms when considering interactions by language (English or Spanish) and health literacy level (lower or higher). Accordingly, for two-way interactions (mode*language or mode*health literacy level), we hypothesized an interaction effect of 0.75, so that the difference in scores between study arms as stratified by language or health literacy level could be as high as $\Delta = 1.5 + 0.75 = 2.25$, and for a three-way interaction (mode*language*health literacy level) the hypothesized interaction effect was hypothesized to be 0.75 with the difference in scores between study arms as stratified by language and health literacy level could be as high as $\Delta = 1.5 + 0.75 + 0.75 = 3.0$. For a two-sided $\alpha = 0.05$, the estimated power for the stratified sample size of n = 1200 was 0.99 without interactions, 0.97 for two-way interactions, and 0.80 for a three-way interaction.

2.6 | Data analyses

Enrollment was summarized using a Consolidated Standards of Reporting Trials (CONSORT; http://www.consort-statement.org) diagram. Participant demographic characteristics were compared by study arm assignment, as stratified by language spoken and health literacy level. Improvement in HIV/AIDS and HIV testing knowledge and increases in HIV testing motivation and behavioral skills after versus before watching the video or reviewing the pictorial brochure, as measured by the study instruments, were summarized by study arm, as stratified by language spoken and health literacy level. Differences were expressed as changes in total mean scores (for knowledge and motivation assessments) or changes in means or proportions (for behavioral skills) in the study instruments. In turn, differences in these increases comparing the video versus pictorial brochure arms were calculated, along with corresponding 95% confidence intervals (CIs). For preferences for the video or the pictorial brochure, we calculated the differences in proportions along with corresponding 95% CIs for those who preferred either delivery method or had no preference before versus after receiving the delivery method to which they had been assigned. These calculations were performed for all participants and by language spoken and health literacy level. We also calculated the differences in HIV/AIDS and HIV testing knowledge mean scores and responses to the HIV testing motivation and behavioral skills questions after versus before information delivery (video or pictorial brochure) by participants' initial preferences for information delivery method.

3 | RESULTS

3.1 | Participant characteristics

Across the four EDs, 4099 patients whose medical record review indicated potential study eligibility agreed to be screened in person for the study. Of these, 2770 were potentially study eligible after screening and 1872 met the language and health literacy quota (Figure 1). The most common reason patients declined study participation were lack of time, feeling unwell, and not wanting to complete surveys. There were 1367 participants in the final study sample. Of the 712 English speakers, 49.4% had lower health literacy, and among the 655 Spanish speakers, 51.1% had lower health literacy. The majority of participants were female, slightly more than half considered themselves to be white (36.4% Hispanic White, 13.8% non-Hispanic White), slightly more than half had Medicare or Medicaid health care insurance, and most had ≤12 years of formal education (Table 1). Within language (English or Spanish) and health literacy groups (lower or higher), the distribution of demographic characteristics were similar between the randomly assigned video and pictorial brochure arms. The majority of participants had been tested for HIV, although HIV testing was more common among English than Spanish speakers (56.6% vs 40.3%; Δ 16.3%, 95% CI: 10.2%, 22.4%). The median time watching the video was 15 minutes for English speakers and 16 minutes for Spanish speakers (including interruptions), and reviewing the pictorial brochure was 13 minutes for

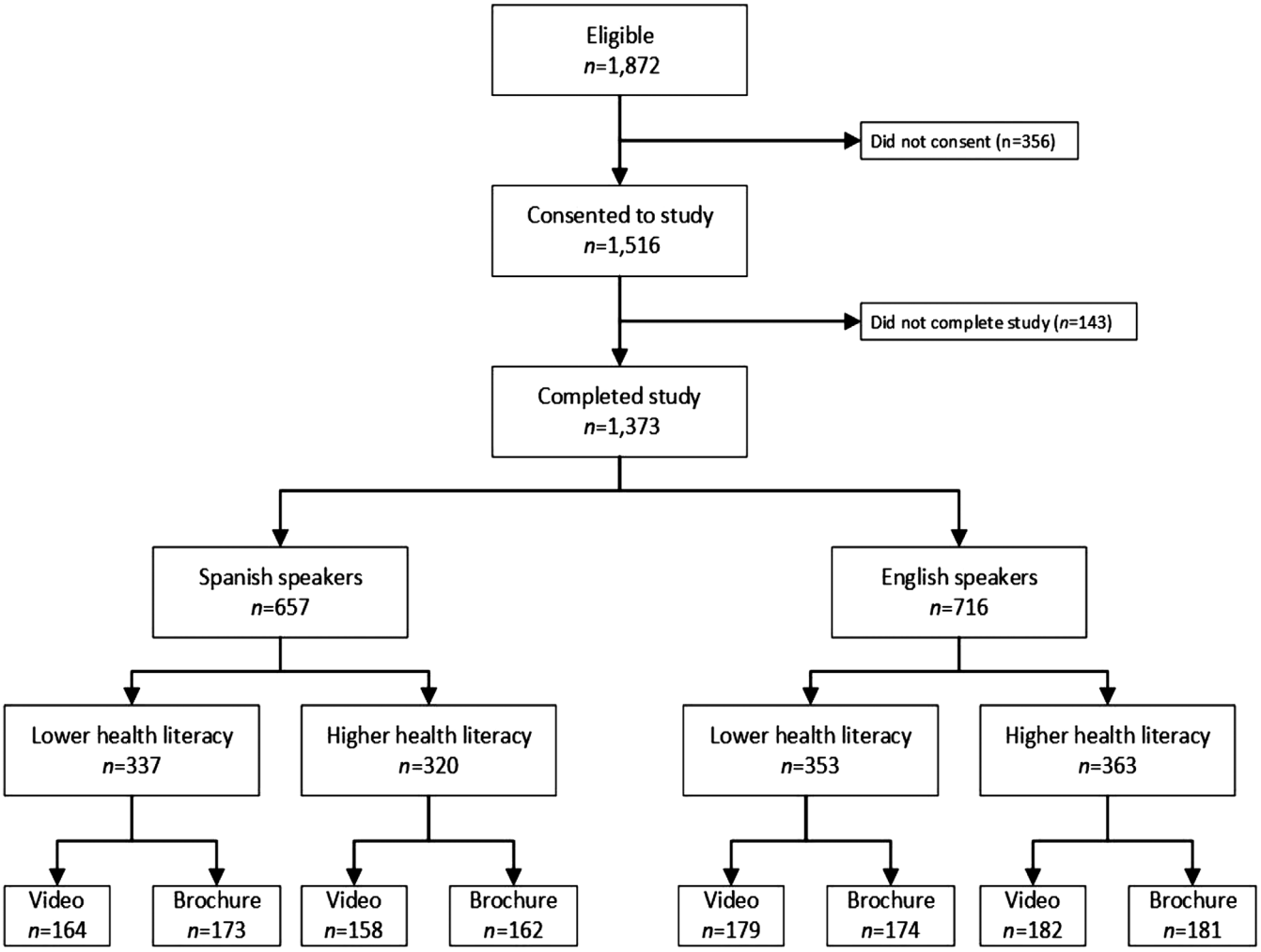

FIGURE 1 Participant enrollment and completion by language, health literacy level, and study arm

English and 20 minutes for Spanish speakers (Table S1). Lower health literacy participants required 3 more minutes to review the pictorial brochure than higher literacy participants.

3.2 | Increase in HIV/AIDS and HIV testing knowledge, video versus pictorial brochure

Increases in total mean scores on the HIV/AIDS and HIV testing knowledge questionnaire after the intervention (video or pictorial brochure) were less than one half of a point (0.43 points on a 25-point scale) greater for participants randomly assigned to the video than the pictorial brochure arm (Table 2). Compared with their counterparts in the brochure arm, participants in the video arm had a slightly higher increase in scores in the Spanish language (Δ 0.61) and lower health literacy arms (Δ 0.57), particularly in the English language lower health literacy arm (Δ 0.67). All these comparisons met a priori statistical significance levels. Otherwise, there were no differences in total mean scores on the HIV/AIDS and HIV testing knowledge questionnaire between groups compared (Table 2). Among the five domains assessed in the questionnaire, only the subscale assessing HIV/AIDS basics (eg, the nature of HIV and AIDS, differences between HIV and AIDS) showed greater knowledge in the video than the pictorial brochure arm. Participants in the video arm had much greater improvement in correct responses for 10 of the 25 items, and those in the pictorial brochure had greater improvement for two items (Table S1). Spanish speakers who watched the video had greater increases in scores than English speakers, but there were no differences by health literacy levels within or across languages spoken (Table S2).

3.3 | Increase in HIV testing motivation and behavioral skills

In general, motivation for HIV testing increased minimally for most participants after watching the video or reviewing the pictorial brochure, regardless of health literacy level and language spoken (Table 3). Prior to watching the video or reviewing the pictorial brochure, 99.0% of the

TABLE 1 Participant demographic characteristics by language spoken, health literacy level, and study arm

		Spanish				English			
		Lower health literacy		Higher health literacy		Lower health literacy		Higher health literacy	
	Overall (n = 1367)	Video (n = 164)	Pictorial brochure (n = 171)	Video (n = 158)	Pictorial brochure (n = 162)	Video (n = 179)	Pictorial brochure (n = 173)	Video (n = 180)	Pictorial brochure (n = 180)
Sex (n[%])									
Male	505 (36.9)	64 (39.0)	71 (41.5)	49 (31.0)	55 (34.0)	71 (39.7)	79 (45.4)	61 (33.1)	54 (30.0)
Female	863 (63.1)	100 (61.0)	100 (58.5)	109 (69.0)	107 (66.0)	108 (60.3)	94 (54.3)	119 (66.1)	126 (70.0)
Age (mean [SD])	43.0 (12.0)	46.5 (10.3)	44.8 (10.9)	43.7 (10.8)	44.9 (10.8)	41.0 (14.0)	41.1 (12.7)	43.7 (10.8)	44.9 (10.8)
Race (n[%])									
White	686 (50.2)	117 (71.3)	131 (76.6)	125 (79.1)	124 (76.5)	32 (17.9)	18 (10.3)	66 (36.7)	73 (40.6)
Black	664 (48.6)	47 (29.7)	40 (23.4)	33 (20.9)	38 (23.5)	144 (80.4)	154 (89.0)	107 (59.4)	101 (56.1)
Other	17 (1.2)	0 (0)	0 (0)	0 (0)	0 (0)	3 (1.7)	1 (0.6)	7 (3.9)	6 (3.3)
Insurance (n[%])[a]									
Private	204 (14.9)	5 (3.0)	7 (4.1)	10 (6.3)	11 (6.8)	28 (15.6)	26 (14.9)	62 (34.4)	55 (30.6)
Governmental	721 (52.7)	85 (51.8)	83 (48.5)	86 (54.4)	88 (54.3)	107 (59.8)	109 (62.6)	81 (45.0)	82 (45.6)
None	439 (32.1)	72 (45.1)	80 (46.8)	62 (39.2)	63 (38.9)	44 (24.6)	37 (21.4)	36 (20.0)	43 (23.9)
Education (n[%])[b]									
Some high school or less	568 (41.6)	123 (75.0)	128 (74.9)	74 (46.8)	87 (53.7)	47 (26.3)	54 (31.0)	36 (20.0)	19 (10.6)
Grade 12 or GED	452 (33.1)	30 (18.3)	36 (21.1)	52 (32.9)	47 (29.0)	97 (54.2)	75 (43.2)	54 (30.0)	61 (33.9)
Some college	258 (18.9)	8 (4.9)	5 (2.9)	19 (12.0)	19 (11.7)	30 (16.8)	38 (22.0)	62 (34.4)	787(42.8)
Completed college or more	85 (6.2)	1 (0.6)	1 (0.6)	12 (7.6)	9 (5.6)	5 (2.8)	6 (3.5)	28 (15.6)	23 (12.8)
Ever tested for HIV (n[%])									
Yes	1003 (73.4)	105 (64.0)	102 (59.6)	115 (72.8)	113 (69.8)	137 (76.5)	146 (84.4)	144 (88.0)	141 (78.3)
No	330 (24.1)	52 (31.7)	65 (38.0)	38 (24.1)	42 (25.9)	38 (21.2)	25 (14.5)	32 (17.8)	38 (21.1)
Did not know or refused to answer	34 (2.5)	7 (4.3)	4 (2.3)	5 (3.2)	7 (4.3)	4 (2.2)	2 (1.2)	4 (2.2)	1 (0.6)

GED, General Education Diploma.

[a]Three participants unsure of insurance status and are not included in Table 1.

[b]Four participants did not provide education level and are not included in Table 1.

1367 participants believed that it was important or very important for ED patients to be tested for HIV, 91.1% believed it was important or very important for themselves to be tested for HIV in the ED. More participants believed that HIV testing was important or very important for all ED patients than it was for them to personally be tested (Δ 7.8%; 95% CI: 6.2, 9.5). Prior to watching the video or reviewing the pictorial brochure, 5% of participants believed that they were "very much," 4% "pretty much," 12% "somewhat," 20% "not much," and 59% "not at risk" for an undiagnosed HIV infection. However, belief in risk of having an undiagnosed HIV increased in both arms after the intervention, but more in the pictorial brochure than the video arm (Table 3). There were no differences between the video and pictorial brochure arms for the behavioral skills assessments in the analysis of all participants and by language and health literacy levels (Table 4). Increase in motivation and improvement in behavioral skills was not related to language spoken or health literacy levels (Tables S3 and S4).

3.4 | Effect of preferences for video or pictorial brochure on HIV/AIDS and HIV testing

Before they watched the video or reviewed the pictorial brochure, approximately half of participants had no preference for either delivery method, while a quarter either preferred the video or the pictorial brochure (Table 5). More participants with lower health literacy than those with higher health literacy preferred the video before receiving their assigned delivery method (29.6% vs 22.1%; Δ 7.5%, 95% CI: 2.8%, 12.1%), particularly among English speakers (32.8% vs 20.3%; Δ 12.4%, 95% CI: 5.9%, 19.0%). Preferences did not change after watching the video or reviewing the pictorial brochure among all participants nor as stratified by language spoken and health literacy level (Table 5). Mean scores on the HIV/AIDS and HIV testing knowledge and HIV testing behavioral skills questionnaire were not affected by receipt of preferred delivery method; however, those who received their

TABLE 2 Differences in HIV/AIDS and HIV testing knowledge between the video and pictorial brochure arms by language spoken and health literacy level

		Language spoken		Health literacy level		Language and health literacy level			
	Overall video vs pictorial brochure Δ (95% CI) (n = 1367)	Spanish video vs pictorial brochure Δ (95% CI) (n = 655)	English video vs pictorial brochure Δ (95% CI) (n = 712)	Lower video vs pictorial brochure Δ (95% CI) (n = 687)	Higher video vs pictorial brochure Δ (95% CI) (n = 680)	Spanish lower video vs pictorial brochure Δ (95% CI) (n = 335)	Spanish higher video vs pictorial brochure Δ (95% CI) (n = 320)	English lower video vs pictorial brochure Δ (95% CI) (n = 352)	English higher video vs pictorial brochure Δ (95% CI) (n = 360)
Total score	0.43 (0.07, 0.80)	0.61 (0.04, 1.18)	0.30 (−0.15, 0.74)	0.57 (0.04, 1.10)	0.30 (−0.19, 0.79)	0.50 (−0.35, 1.36)	0.72 (−0.04, 1.48)	0.67 (0.03, 1.30)	−0.06 (−0.67, 0.55)
Domains									
Definition and nature of HIV/AIDS	0.14 (0.01, 0.26)	0.06 (−0.14, 0.26)	0.21 (0.06, 0.36)	0.13 (−0.06, 0.31)	0.15 (−0.03, 0.32)	0.01 (−0.28, 0.31)	0.11 (−0.16, 0.39)	0.25 (0.03, 0.47)	0.18 (−0.03, 0.39)
HIV prevention	0.12 (−0.01, 0.25)	0.16 (−0.05, 0.36)	0.09 (−0.08, 0.26)	0.04 (−0.16, 0.23)	0.21 (0.04, 0.38)	0.03 (−0.27, 0.33)	0.28 (0.02, 0.55)	0.05 (−0.21, 0.30)	0.14 (−0.09, 0.37)
HIV transmission	0.11 (−0.03, 0.25)	0.20 (−0.01, 0.41)	0.04 (−0.14, 0.21)	0.31 (0.11, 0.52)	−0.09 (−0.27, 0.08)	0.40 (0.08, 0.72)	−0.01 (−0.28, 0.26)	0.24 (−0.02, 0.50)	−0.16 (−0.39, 0.07)
Meaning of HIV test results	0.00 (−0.13, 0.13)	0.04 (−0.16, 0.24)	−0.04 (−0.20, 0.12)	0.03 (−0.15, 0.21)	−0.04 (−0.22, 0.15)	0.01 (−0.27, 0.29)	0.07 (−0.23, 0.37)	0.06 (−0.17, 0.29)	−0.13 (−0.36, 0.10)
HIV testing methods	0.07 (−0.05, 0.18)	0.15 (−0.02, 0.33)	−0.01 (−0.16, 0.14)	0.06 (−0.1, 0.22)	0.07 (−0.09, 0.23)	0.05 (−0.19, 0.30)	0.26 (0.01, 0.5)	0.08 (−0.13, 0.29)	−0.09 (−0.30, 0.12)

CI, confidence interval.

non-preferred format were more likely to increase their self-perception of having an undiagnosed HIV infection (Tables S5, S6, and S7).

TABLE 3 Differences in HIV testing motivation scores between the video and pictorial brochure study arms by language spoken and health literacy level

		Language spoken		Health literacy level		Language and health literacy level			
	Overall video vs pictorial brochureΔ (95% CI) (n = 1367)	Spanish video vs pictorial brochureΔ (95% CI) (n = 655)	English video vs pictorial brochureΔ (95% CI) (n = 712)	Lower video vs pictorial brochureΔ (95% CI) (n = 687)	Higher video vs pictorial brochureΔ (95% CI) (n = 680)	Spanish lower video vs pictorial brochureΔ (95% CI) (n = 335)	Spanish higher video vs pictorial brochureΔ (95% CI) (n = 320)	English lower video vs pictorial brochureΔ (95% CI) (n = 352)	English higher video vs pictorial brochureΔ (95% CI) (n = 360)
HIV testing important for all ED patients[a]	0.03 (−0.01, 0.07)	0.00 (−0.07, 0.07)	0.06 (0.01, 0.11)	0.02 (−0.04, 0.09)	0.04 (−0.01, 0.10)	0.01 (−0.09, 0.11)	−0.01 (−0.09, 0.08)	0.04 (−0.03, 0.11)	0.08 (0.01, 0.15)
HIV testing important for self[b]	0.05 (−0.03, 0.14)	0.05 (−0.06, 0.15)	0.06 (−0.06, 0.18)	0.04 (−0.07, 0.15)	0.07 (−0.05, 0.18)	0.06 (−0.09, 0.21)	0.03 (−0.11, 0.17)	0.03 (−0.14, 0.19)	0.10 (−0.08, 0.28)
Perceived risk of possible undiagnosed HIV infection[c]	−0.16 (−0.28, −0.05)	−0.21 (−0.39, −0.03)	−0.13 (−0.28, 0.03)	−0.15 (−0.33, 0.03)	−0.17 (−0.33, −0.02)	−0.31 (−0.57, −0.05)	−0.10 (−0.36, 0.15)	−0.02 (−0.27, 0.23)	−0.23 (−0.41, −0.04)

CI, confidence interval.
[a]Three participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.
[b]Zero participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.
[c]One hundred and seventy-eight participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.

4 | LIMITATIONS

This investigation has several limitations. First, even though we strove to include a diverse population of ED patients, it is possible that our findings are not generalizable to US EDs with dissimilar sociodemographic characteristics. We particularly cannot attest to the validity of the findings for patients excluded from the trial, especially those unable to read English or Spanish at a second grade level and those who speak other languages. Further, we also recognize that participants who joined the study might already have higher HIV/AIDS and HIV testing knowledge and greater motivation and behavioral skills around HIV testing than those who declined study participation. Unfortunately, this difference cannot be measured. Second, at present, there is no definitive standard for assessing health literacy. Other instruments might have grouped participants in a different manner, and thus, using these might have resulted in either lesser or greater differences in HIV/AIDS and HIV testing knowledge, motivation, and behavioral skills improvement for those randomly assigned to the video or pictorial brochure arms. We believe that the SAHL-S&E is a reasonable assessment of health literacy, given its strong psychometric properties in relation to other health literacy instruments. Third, there also is no accepted standard for assessing HIV/AIDS and HIV testing knowledge, motivation, and behavioral skills. Other instruments could have yielded different outcomes between the two study arms or more nuanced findings. Fourth, small differences observed between groups might not have clinical importance, although they reached a priori statistical significance. Fifth, although CDC recommends providing HIV/AIDS and HIV testing information and has suggested content for this information, the ultimate benefit to patients from providing it has not been established and could not be assessed in this investigation. Future work can examine if providing this information impacts future patient behavior. Sixth, this investigation only reports on immediate gains in knowledge, motivation, and behavioral skills, as opposed to longer-term knowledge retention and behavior changes. These aspects will be examined in the ongoing longitudinal trial.

5 | DISCUSSION

We found that a pictorial brochure derived from a video improved HIV/AIDS and HIV testing knowledge yet only slightly increased HIV testing motivation and behavioral skills among adult English- or Spanish-speaking ED patients. However, knowledge improvement was slightly better for the video, as compared to the pictorial brochure, and the video was modestly better for patients with lower health literacy. However, the difference in knowledge improvement was not large enough to abandon any further consideration of the pictorial brochure. Particularly for higher health literacy adult ED patients, the pictorial

TABLE 4 Differences in HIV testing behavioral skills scores between the video and pictorial brochure study arms by language spoken and health literacy level

		Language spoken		Health literacy level		Language and health literacy level			
	Overall video versus pictorial brochureΔ (95% CI) (n = 1367)	Spanish video vs pictorial brochureΔ (95% CI) (n = 655)	English video vs pictorial brochureΔ (95% CI) (n = 712)	Lower video vs pictorial brochureΔ (95% CI) (n = 687)	Higher video vs pictorial brochureΔ (95% CI) (n = 680)	Spanish lower video vs pictorial brochureΔ (95% CI) (n = 335)	Spanish higher video vs pictorial brochureΔ (95% CI) (n = 320)	English lower video vs pictorial brochureΔ (95% CI) (n = 352)	English higher video vs pictorial brochureΔ (95% CI) (n = 360)
Repeat HIV testing after a negative test after recent sex (% correct)	3.6 (−0.4, 7.6)	4.1 (−2.2, 10.4)	3.4 (−1.5, 8.4)	2.7 (−2.4, 7.8)	4.7 (−1.5, 10.8)	4.4 (−4.1, 13)	3.7 (−5.5, 12.9)	1.5 (−3.9, 6.8)	5.6 (−2.6, 13.7)
HIV testing because of new sexual partner (% correct)	−0.7 (−3.1, 1.7)	−0.4 (−4.1, 3.2)	−0.9 (−4, 2.2)	−0.3 (−4, 3.5)	−1.1 (−4.0, 1.7)	0.9 (−4.7, 6.5)	−1.8 (−6.3, 2.8)	−1.3 (−6.4, 3.7)	−0.6 (−4.1, 3)
Interpretation of negative HIV test result (% correct)	−0.5 (−3.1, 2)	1.8 (−2.5, 6.2)	−2.6 (−5.2, 0.0)	−0.9 (−4.6, 2.9)	−0.2 (−3.5, 3.1)	2.2 (−4.2, 8.6)	1.5 (−4.5, 7.4)	−3.5 (−7.6, 0.5)	−1.7 (−4.9, 1.5)
Confidence in knowing when you should get an HIV test[a] (mean)	0.05 (−0.03, 0.14)	0.05 (−0.06, 0.15)	0.06 (−0.06, 0.18)	0.04 (−0.07, 0.15)	0.07 (−0.05, 0.18)	0.06 (−0.09, 0.21)	0.03 (−0.11, 0.17)	0.03 (−0.14, 0.19)	0.10 (−0.08, 0.28)
Confidence in knowing what to do to get an HIV test[b] (mean)	−0.16 (−0.28, −0.05)	−0.21 (−0.39, −0.03)	−0.13 (−0.28, 0.03)	−0.15 (−0.33, 0.03)	−0.17 (−0.33, −0.02)	−0.31 (−0.57, −0.05)	−0.10 (−0.36, 0.15)	−0.02 (−0.27, 0.23)	−0.23 (−0.41, −0.04)
Confidence in understanding results of HIV testing[c] (mean)	0.05 (−0.03, 0.14)	0.05 (−0.06, 0.15)	0.06 (−0.06, 0.18)	0.04 (−0.07, 0.15)	0.07 (−0.05, 0.18)	0.06 (−0.09, 0.21)	0.03 (−0.11, 0.17)	0.03 (−0.14, 0.19)	0.10 (−0.08, 0.28)

CI, confidence interval.

[a]One hundred and thirty-nine participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.

[b]One hundred and twelve participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.

[c]One hundred and five participants not included because of refusal to respond or stating they did not know, pre- and/or post-intervention.

TABLE 5 Video or pictorial brochure preferences pre- and post-watching video or reviewing pictorial brochure by language spoken and health literacy level

	Overall (n = 1308)			Language spoken						Health literacy					
				Spanish (n = 641)			English (n = 647)			Lower (n = 643)			Higher (n = 665)		
Preferences	Pre %	Post %	Change (95% CI)	Pre %	Post %	Change (95% CI)	Pre %	Post %	Change (95% CI)	Pre %	Post %	Change (95% CI)	Pre %	Post %	Change (95% CI)
Pictorial brochure	23.3	22.0	−1.3 (−4.5, 1.9)	26.8	25.3	−1.5 (−6.3, 3.3)	19.9	18.9	−1.0 (−5.3, 3.3)	24.9	22.4	−2.5 (−7.1, 2.1)	21.8	21.7	−0.1 (−4.6, 4.4)
Video	25.8	27.7	1.9 (−1.5, 5.3)	25.3	27.0	1.7 (−3.1, 6.5)	26.2	28.3	2.1 (−2.8, 7)	29.6	32.8	3.2 (−1.9, 8.3)	22.1	22.7	0.6 (−4.0, 5.2)
Either video or pictorial brochure	50.9	50.3	−0.6 (−4.4, 3.2)	47.9	47.7	−0.2 (−5.7, 5.3)	53.8	52.8	−1.0 (−6.4, 4.4)	45.6	44.8	−0.8 (−6.2, 4.6)	56.1	55.6	−0.5(−5.9, 4.9)

	Language spoken and health literacy											
	Spanish lower (n = 326)			Spanish higher (n = 315)			English lower(n = 317)			English higher(n = 350)		
Pictorial brochure	28.5	25.1	−3.4 (−10.2, 3.4)	25.1	25.4	0.3 (−6.5, 7.1)	21.1	19.6	−1.5 (−7.8, 4.8)	18.9	18.3	−0.6 (−6.4, 5.2)
Video	26.4	30.0	3.6 (−3.3, 10.5)	24.1	23.8	−0.3 (−7.0, 6.4)	32.8	35.6	2.8 (−4.6, 10.2)	20.3	21.7	1.4 (−4.6, 7.4)
Either video or pictorial brochure	45.1	44.8	−0.3 (−7.9, 7.3)	50.8	50.8	0.0 (−7.8, 7.8)	46.1	44.8	−1.3 (−9.1, 6.5)	60.9	60.0	−0.9 (−8.1, 6.3)

CI, confidence interval.

brochure is an acceptable substitute for the video. Because of the practical constraints of using the video because of its length and the need for additional equipment to display it, the pictorial brochure might be useful in busy ED and resource-limited settings, despite its slightly lesser performance in improving HIV/AIDS and HIV testing knowledge. It was surprising to us that the video did not greatly outperform the pictorial brochure for lower health literacy patients, given concerns about the reading skills required for the brochure. It is possible that although general literacy and health literacy are related concepts, lower health literacy participants had adequate reading skills that enabled them to derive benefit from the pictorial brochure. However, it also indicates a continued need to identify approaches to reduce disparities in health care for adult ED lower health literacy patients.

Although HIV testing motivation increased for both the video and the pictorial brochure, the increase was modest, and there were no differences between the two delivery modes. On the other hand, it is noteworthy that HIV testing motivation was very high among these adult ED patients at baseline, which indicated at least they were supportive of HIV testing. It is possible, though, that the patients who agreed to participate in the study were already interested in HIV testing, given they knew they would be offered HIV testing as part of the study. Future research could assess if the video or pictorial brochure helps motivate ED patients who express reluctance in being tested. There also were no differences in behavioral skills between the two delivery methods, which suggests that they might be similarly efficacious improving these skills associated with knowing when and being tested for HIV.

In conclusion, the video, "What do you know about HIV and HIV testing," and a comparable pictorial brochure both led to increased HIV/AIDS and HIV testing knowledge among adult English- or Spanish-speaking ED patients. The video resulted in slightly better knowledge improvement, but the pictorial brochure might be of value as part of the tools available to ED to facilitate HIV testing. Efforts are still necessary to identify approaches to assist lower health literacy patients in achieving knowledge gains so that they achieve similar knowledge gains as higher health literacy patients from information provided as part of HIV testing.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORS CONTRIBUTIONS

RCM as principal investigator takes responsibility for the manuscript as a whole. SJM was responsible for conducting the study analyses, under the supervision of TL. MAC, MPC, and TL contributed to the study design, execution, and analysis. All investigators contributed to the preparation of the manuscript.

ORCID

Roland C. Merchant MD, MPH, ScD
https://orcid.org/0000-0001-7571-1294

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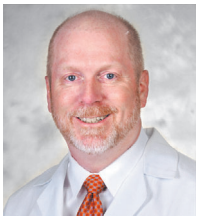
AUTHOR BIOGRAPHY



Roland C. Merchant, MD, MPH, ScD is Associate Professor of Emergency Medicine and Epidemiology at Brigham and Women's Hospital, Harvard Medical School. He has a master's degree in public health (quantitative methods) and a doctorate in epidemiology from the Harvard School of Public Health.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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