Effect of a Brief Video Intervention on Incident Infection among Patients Attending Sexually Transmitted Disease Clinics

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Abbreviations: STD, sexually transmitted disease

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ABSTRACT

Background

Sexually transmitted disease (STD) prevention remains a public health priority. Simple, practical interventions to reduce STD incidence that can be easily and inexpensively administered in high-volume clinical settings are needed. We evaluated whether a brief video, which contained STD prevention messages targeted to all patients in the waiting room, reduced acquisition of new infections after that clinic visit.

Methods and Findings

In a controlled trial among patients attending three publicly funded STD clinics (one in each of three US cities) from December 2003 to August 2005, all patients ($n = 38,635$) were systematically assigned to either a theory-based 23-min video depicting couples overcoming barriers to safer sexual behaviors, or the standard waiting room environment. Condition assignment alternated every 4 wk and was determined by which condition (intervention or control) was in place in the clinic waiting room during the patient's first visit within the study period. An intent-to-treat analysis was used to compare STD incidence between intervention and control patients. The primary endpoint was time to diagnosis of incident laboratory-confirmed infections (gonorrhea, chlamydia, trichomoniasis, syphilis, and HIV), as identified through review of medical records and county STD surveillance registries. During 14.8 mo (average) of follow-up, 2,042 patients (5.3%) were diagnosed with incident STD (4.9%, intervention condition; 5.7%, control condition). In survival analysis, patients assigned to the intervention condition had significantly fewer STDs compared with the control condition (hazard ratio [HR], 0.91; 95% confidence interval [CI], 0.84 to 0.99).

Conclusions

Showing a brief video in STD clinic waiting rooms reduced new infections nearly 10% overall in three clinics. This simple, low-intensity intervention may be appropriate for adoption by clinics that serve similar patient populations.

Trial registration: http://www.ClinicalTrials.gov (#NCT00137670).

The Editors' Summary of this article follows the references.

Introduction

Approximately 19 million incident cases of sexually transmitted infections occur in the United States annually [1]. While several effective interventions have been developed for patients at risk for infection [2–6], these interventions typically focus on individual or group risk reduction, involve multiple sessions, and require significant resources to implement. Simple, practical interventions that can reduce sexually transmitted disease (STD) incidence in high-volume clinical settings are needed to complement existing prevention activities.

Video interventions offer a pragmatic mechanism for delivering STD prevention messages because of their relative low cost and ease of implementation, likely acceptability, and high likelihood of being adopted and sustained if found effective. In previous studies of STD clinic patients, brief video-based interventions, typically combined with individual or small-group counseling, have been associated with reductions in risky sexual behavior [7,8] and new infections [9,10]. However, the complexity and expense of administering these behavioral interventions may present barriers to adoption and implementation that simply showing a video does not.

We conducted a controlled multisite trial to evaluate whether a brief video, which contained STD prevention messages targeted to all patients in the waiting room, was effective in reducing acquisition of new infections after that clinic visit.

Methods

Patients, Sites, and Consent

The trial was conducted at three public STD clinics, one each in Denver (Colorado), in Long Beach (California), and San Francisco (California) from December 2003 through August 2005. All patients attending those clinics during that 20-mo period were included.

The institutional review boards at each site and the Centers for Disease Control and Prevention reviewed and approved the study protocol (Text S1). A waiver of informed consent was obtained, given that patients were not actively recruited and only routinely collected data were used. A CONSORT checklist was completed for this study (Text S2).

Study Design

We used a controlled trial design, in which the intervention condition (i.e., the video *Safe in the City*, supplemented by movie-style posters) and the control condition (i.e., standard waiting room experience) were systematically administered in alternating 4-wk blocks of time. Routinely collected data were abstracted electronically (Denver and San Francisco) or manually (Long Beach) from clinic medical records for dates of the index visit (i.e., first visit during the study period) as well as dates of all subsequent clinic visits, reason for index visit, date of birth, sex, race/ethnicity, age, and sexual orientation, and STD diagnoses at both initial and subsequent visits. Clinical medical record data and external county STD surveillance registries were reviewed after completion of follow-up (December 2005) to identify and compare incident infections between groups of patients defined by the study condition at their index visit.

For condition assignment, we used a blocking scheme consisting of 11 identical 8-wk cycles (4 wk for control and 4 wk for intervention). This block length was selected to minimize contamination between conditions and avoid biases from secular trends in STD incidence. The order of condition assignment for the first cycle (i.e., control followed by intervention) was randomly determined by a coin toss. This order was maintained throughout the trial in each clinic.

Based on an integrated theoretical approach to achieving health behavior change [11–14], the intervention condition consisted of a video that incorporated key prevention messages aimed at increasing knowledge and perception of STD/HIV risk, promoting positive attitudes toward condom use, and building self-efficacy and skills to facilitate partner treatment, safer sex, and the acquisition, negotiation, and use of condoms. The 23-min video contained three discrete, related vignettes that modeled young couples of diverse racial/ethnic backgrounds and sexual orientations in various types of relationships negotiating safer sexual behavior (Text S3). Animated segments demonstrated proper condom use and the variety of condoms available. Posters in the waiting room and exam rooms directed attention to the video and reinforced key messages. Additional details regarding the development and content of the *Safe in the City* intervention have been reported elsewhere [15] and can be found at http://www.safeinthecity.org. During each intervention cycle, each site monitored intervention exposure (i.e., viewership) by anonymously surveying a convenience sample of approximately 25 patients after their clinic visit. The frequency with which the video was played was adjusted accordingly in an effort to maximize coverage until 80% of sampled clinic attendees reported seeing most or all of the video and could identify a key prevention message.

For the control condition, patients experienced the standard waiting room environment, in the absence of video and posters. This condition differed by site and included television programming, music, or both.

Condoms and educational pamphlets on STD prevention were available to all patients in both conditions throughout the study period.

Outcomes

For primary outcomes, incident STDs included laboratory-confirmed diagnoses of gonorrhea, chlamydia, trichomoniasis (females only), primary or secondary syphilis, and HIV infection, as documented in clinic records or review of local notifiable disease registries. For the latter, incident infections for reportable STDs in California and Colorado (gonorrhea, chlamydia, syphilis, and HIV) were matched to patient clinic records based on first and last names and dates of birth, and/or SOUNDEX code algorithms. Incident diagnoses were defined as follows: for gonorrhea and chlamydia, a positive cervical, urethral, or rectal test by Gram stain, culture, or urine-based screening (the latter being used most commonly at all three clinics); for trichomoniasis, clinical diagnosis supplemented by a positive wet mount; for primary or secondary syphilis, positive test result (i.e., darkfield microscopy or RPR/MHA-TP) with clinical diagnosis; and for HIV, documented positive antibody test by standard EIA/WB algorithm following negative antibody test in the same clinic. For these STDs, an incident infection was defined as any laboratory-confirmed infection diagnosed after the index

visit. The one exception was that we excluded infections from patients who received the same diagnosis at the index and follow-up visits within 30 d; these infections may have represented persistent positive diagnostic test results. Each clinic followed standard local protocols for testing, diagnosis, and treatment of STDs as well as partner notification that were consistent with existing national guidelines.

Statistical Analysis

In designing the study, we assumed 5% per year cumulative incidence of these STDs in the absence of intervention, and thus estimated that a sample size of approximately 45,000 patient record abstractions would be required to detect a 10% reduction in annual STD incidence with 80% power at the 10% significance level when based on a comparison of two binomial proportions. Condition assignments were masked for analysts and investigators during primary analyses.

Medical records and surveillance data were reviewed for all patients with valid visit dates, although we excluded 1,647 patients (<5%) from analyses a priori because they participated in a separate behavioral assessment of this intervention involving active follow-up. Inclusion of these patients did not alter results. Following an intent-to-treat approach, we used the Kaplan-Meier survival method with the Greenwood variance estimator to compute cumulative STD incidence and to compare incidence between conditions as a function of time from the index clinic visit [16]. Patient observation time was censored at the time of diagnosis for the first new laboratory-confirmed infection or the end of follow-up. Unless documented in local notifiable disease registries, patients in both conditions who did not return to the clinics during the study period, as well as those who returned but did not receive a diagnosis of new infection, were assumed not to have incident STD. Because the systematic assignment of condition (i.e., control followed by intervention) resulted in control patients having an additional 4 wk of follow-up as compared with intervention patients, we repeated all primary analyses such that the end date of follow-up for control patients ended 4 wk earlier; these analyses also did not alter results.

Cox proportional hazards models were developed to estimate hazard ratios for the effect of condition assignment on STD incidence over time. The models were fitted with a single covariate (study condition) for the primary analysis to assess the overall effect of the intervention. We additionally performed six planned secondary analyses to assess whether intervention effects varied by sex, race/ethnicity, age, sexual orientation, laboratory-confirmed STD diagnosis at the index visit, and study site. Because of the exploratory nature of these secondary analyses, no adjustments were made for multiple comparisons. Apart from estimating intervention effects, we also conducted multivariable analyses stratified by sex to determine independent risk factors for incident infection. To be included in the final model, all covariates considered were required to be significant or specified a priori as risk factors from the existing literature. All models were found to satisfy assumptions for proportional hazards modeling and goodness of fit. All analyses were performed by using SAS statistical software (version 9.1, SAS Institute) and were conducted by one author (CBB). All statistical tests were two-tailed and are presented at the more conservative 0.05 significance level to minimize the likelihood of type I error.

Results

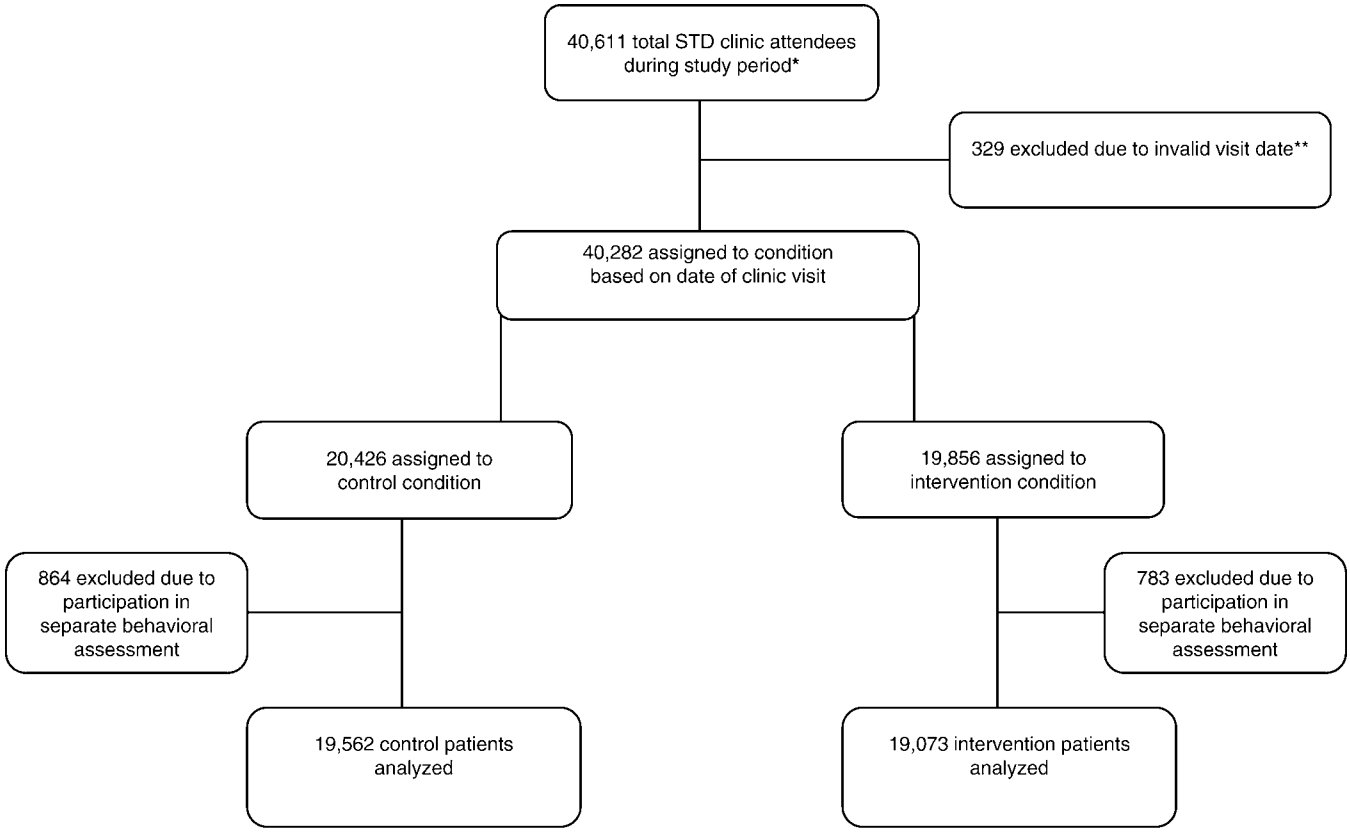
Data on 38,635 patients who visited participating STD clinics from December 2003 to August 2005 were included in analyses (Figure 1). Most patients were male (70%), members of minority races/ethnicities (54%), aged 25 y or older (69%), heterosexual (78%), and attended clinics in San Francisco (51%) or Denver (41%). Overall, 5,990 patients (16%) were diagnosed with one or more laboratory-confirmed infections (primarily gonorrhea or chlamydia) at the index visit. The numbers and characteristics of patients assigned to each condition were well-matched and approximately equal (Table 1).

Altogether, 15,480 patients (40.1%) returned to the clinic for a subsequent visit: 8,483 returned for one visit, 3,044 for two visits, and 3,953 for three or more visits. Neither the overall proportions of patients who made return visits (40.1% for intervention versus 40.0% for control; Fisher exact test, $p = 0.86$) nor the mean numbers of return visits (0.80 visits for intervention versus 0.85 visits for control; Wilcoxon test, $p = 0.39$) differed significantly by condition.

Of the subgroup of 756 patients anonymously surveyed during intervention periods to broadly monitor intervention exposure, 576 (76%) reported viewing "most" or "all" of the video and identified at least one of five main prevention messages noted earlier that were designated a priori by investigators. Intervention exposure in this subgroup was significantly higher among patients who reported wait times of $\geq$ 20 min compared with $<$ 20 min (81% versus 52%; Fisher exact test, $p < 0.001$) and at clinics in Denver or Long Beach (combined) compared with San Francisco (82% versus 68%; Fisher exact test, $p < 0.01$). Although limited by small sample sizes, overall viewership levels appeared to remain constant across intervention periods (range, 71%–87%).

During a mean of 14.8 mo of observation (range 4–24 mo), one or more new laboratory-confirmed STDs were diagnosed for 2,042 patients (5.3%), comprising 2,418 total infections. First incident STDs were as follows: 948 patients (2.5%), gonorrhea (409 intervention, 539 control); 1,239 patients (3.2%), chlamydia (573 intervention and 666 control); 142 patients (0.4%), trichomoniasis (71 intervention and 71 control); 75 patients (0.2%), primary or secondary syphilis (35 intervention and 40 control); and 14 patients (< 0.1%), HIV infection (four intervention and ten control). Multiple STDs were diagnosed for some patients. Most patients diagnosed with an STD (77%) received diagnoses in the STD clinics as opposed to other facilities, as reported through disease registries; the proportions of patients receiving clinic diagnoses were similar between conditions (77.3% for intervention versus 76.5% for control; Fisher exact test, $p = 0.67$).

Fewer incident infections were diagnosed for patients assigned to the intervention condition than for patients assigned to the control condition (4.9% versus 5.7%) (Table 2). The largest reductions in the numbers of new infections were observed for gonorrhea and chlamydia. Cumulative STD incidence was consistently lower among patients in the intervention than in the control condition, beginning at 6 mo after the index visit (Figure 2). Intervention exposure significantly reduced STD incidence (overall hazard ratio



*Study period ranged from 12/1/03 through 8/15/2005 in San Francisco and Long Beach, and through 8/19/2005 in Denver.
**One patient in Long Beach visited the clinic on the weekend when neither condition was allocated and was excluded. Additionally, the start of the final intervention block was delayed two weeks in Denver and thus 328 patients who sought medical care between 7/11/2005 and 7/26/2005 were excluded.

Figure 1. Trial Profile
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[HR], 0.91; 95% confidence interval [CI], 0.84 to 0.99). The point estimate for the intervention effect remained essentially unchanged when observation times were additionally censored upon the date of the first documented exposure to the alternate study condition (i.e., when patients in the control group were first exposed to the intervention condition, and vice versa) (overall HR, 0.90; 95% CI, 0.81 to 1.00). Similar intervention effects also were observed when analyses were restricted to the two most common incident infections (gonorrhea and chlamydia), regardless of whether observation times were censored (overall HR, 0.89; 95% CI, 0.80 to 0.99) or not (overall HR, 0.91; 95% CI, 0.83 to 1.00). The intervention effect also was similar when we limited infections only to those identified in participating STD clinics by excluding infections identified through county disease registries (overall HR, 0.92; 95% CI, 0.83 to 1.02).

Planned subgroup analyses suggested that reductions in STD incidence were statistically significant among intervention (versus control) patients who received STD diagnoses at the index visit (HR, 0.86), who were $\geq$ 25 y old (HR, 0.85), who were male (HR, 0.87) (particularly heterosexual males [HR, 0.84]), and who attended the San Francisco clinic (HR, 0.87), but not their counterparts (Table 2). No significant intervention effect was observed among females (HR, 1.06).

Multivariable analyses stratified by sex revealed several risk factors predictive of incident infection (Table 3). For males, significant predictors of subsequent infection included being African American or Hispanic, $<$ 25 y old, reporting sex with other males, and receiving an STD diagnosis at the index visit. For females, significant predictors included being African American or Hispanic, $<$ 25 y old, and receiving an STD diagnosis at the index visit.

Discussion

Compared with the standard waiting room experience, the *Safe in the City* video intervention significantly reduced the incidence of laboratory-confirmed infections among patients attending these STD clinics. Given the large number of patients visiting public STD clinics annually, the approximately 10% effect size observed in this study could result in clinically meaningful reductions in new infections if applied to clinics with similar populations where the intervention is similarly effective. Clinics may be willing to adopt simple, low-cost, low-intensity waiting room interventions, which can be administered with minimal staff time as part of a routine clinic visit, in addition to more intensive but effective interventions that require additional patient or staff time to implement.

Earlier research by O'Donnell et al. [9] and Cohen et al. [10]

Table 1. Characteristics of 38,635 Patients Attending STD Clinics in Three U.S. Cities, December 2003–August 2005, by Study Condition

Baseline Characteristics	Category	Intervention ($n = 19,073$)	Control ($n = 19,562$)
Sex/gender, %	Male	69	70
	Female	30	30
	Transgender	<1	<1
Race/ethnicity, %	White, non-Hispanic	46	46
	Black, non-Hispanic	18	19
	Hispanic	25	25
	Other/missing	11	11
Age, y, %	< 25	31	31
	≥ 25	69	69
Site, %	San Francisco	51	51
	Denver	41	41
	Long Beach	8	8
Sexual orientation (males only), %	Heterosexual	69	69
	Men who have sex with men	31	31
Laboratory-confirmed infection at index visit, %[a]	Yes	16	15
	Yes, gonorrhea	6	5
	Yes, chlamydia	10	10
	Yes, trichomoniasis	1	1
	Yes, syphilis	<1	<1
	Yes, HIV	<1	<1
	No	84	85
Reason for index visit, %	New symptoms	56	55
	Contact to an STD	10	10
	Other [b]	34	35

[a]Includes gonorrhea, chlamydia, trichomoniasis (females only), primary or secondary syphilis, or HIV infection.
[b]Includes, for example, visits for routine STD screening / check-up, follow-up for a previous positive test, HIV testing, emergency contraception, and family planning.
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found that brief video-based interventions, typically conducted with group or individual counseling, can reduce infections among specific groups of STD clinic patients. Extending that research, our findings demonstrate that a video-alone intervention without such counseling can also reduce infections among entire STD clinic populations. To our knowledge, only the study by O'Donnell et al. among African American and Hispanic male patients attending New York City STD clinics [9] also included a video-alone arm. Our findings suggest that patients in these STD clinic populations generally paid attention to the video despite competition for their attention in the waiting room (e.g., encounters with clinic and administrative staff, cell phone conversations, availability of reading materials). Using the waiting room as an opportunity to provide prevention interventions may maximize the "teachable moment" [17] during which patients, already cognizant of their elevated STD risk, may be most amenable and receptive to intervention.

Like previous studies [9,10], our study suggested that there were significant intervention effects among males, older patients, and patients who had a diagnosis of infection at the index visit, though our subgroup findings were the product of secondary analyses and thus should be interpreted with caution. Males in particular appear to have benefited from exposure to the *Safe in the City* intervention. Among females, however, we found no evidence of a significant beneficial (or harmful) intervention effect, which may reflect a true lack of video effectiveness, the limitations of using passive follow-up to ascertain incident STD outcomes (given the asymptomatic nature of many infections in women), and generally lower STD incidence and a smaller number of patients among females. Given that the apparent lack of effect observed in women is consistent with other studies [7,10], additional research is needed on the effectiveness of brief interventions among at-risk females who visit STD clinics and whether such interventions may be better targeted toward males. We also observed a significant intervention effect only among patients at the San Francisco clinic, but note that this clinic had the largest number of patients, the highest proportion of males, and the highest incidence of new infections, and thus was most likely to demonstrate a statistically significant effect in subgroup analyses if such an effect was truly present. While we could not rule out a null effect at the Denver and Long Beach sites, we note that the intervention effects observed for these two sites were not statistically different from the significant intervention effect observed in San Francisco (Wald test, $p > 0.10$). Because these findings as a whole suggest that the intervention may have been more effective in some patient subgroups than others, the conduct of additional studies specifically designed to examine effectiveness in these groups would be beneficial.

Our findings are subject to several limitations. Due to the structural nature of our waiting room intervention, some patients in the intervention condition probably did not see the video in its entirety or at all. Additionally, the record review documented that 26% of patients had been exposed to the alternative study condition at some point during follow-up, and we may have missed the point of this exposure for other patients. The true magnitude of risk reduction is likely to be greater than our estimate, given that incomplete exposure and undetected contamination would tend to obscure intervention effectiveness.

Clinicians also were not blinded to condition assignment,

Table 2. Association Between Intervention Exposure and Diagnosis of Incident Laboratory-confirmed Infection [a] among Patients at STD Clinics in Three U.S. Cities, December 2003–August 2005, by Selected Patient Characteristics

Characteristic	Category	Intervention		Control		Hazard Ratio for Condition Effect (95% CI)[c]
		No. Patients	No. (%) Patients with New STD	No. Patients	No. (%) Patients With New STD	
All patients	—	19,073	929 (4.9)	19,562	1,113 (5.7)	0.91 (0.84, 0.99)
Sex/gender	Male	13,219	660 (5.0)	13,715	843 (6.1)	0.87 (0.78, 0.96)
	Female	5,819	267 (4.6)	5,804	267 (4.6)	1.06 (0.89, 1.25)
	Transgender	34	2 (5.9)	43	3 (7.0)	0.88 (0.15, 5.29)
Race/ethnicity	White, non-Hispanic	8,752	356 (4.1)	8,957	399 (4.5)	0.97 (0.84, 1.12)
	Black, non-Hispanic	3,488	277 (7.9)	3,615	341 (9.4)	0.91 (0.78, 1.07)
	Hispanic	4,838	216 (4.5)	4,974	272 (5.5)	0.87 (0.72, 1.04)
	Other/missing	1,995	80 (4.0)	2,016	101 (5.0)	0.86 (0.64, 1.16)
Age, y	<25	5,987	359 (6.0)	6,041	376 (5.5)	1.02 (0.88, 1.17)
	≥25	13,084	570 (4.4)	13,521	737 (6.2)	0.85 (0.77, 0.95)
Site	San Francisco	9,773	513 (5.2)	9,942	645 (6.5)	0.87 (0.78, 0.98)
	Denver	7,785	385 (4.9)	8,009	436 (5.4)	0.94 (0.82, 1.08)
	Long Beach	1,515	31 (2.0)	1,611	32 (2.0)	1.13 (0.69, 1.85)
Sexual orientation[b]	Heterosexual	9,071	256 (2.8)	9,302	333 (3.6)	0.84 (0.71, 0.98)
	Men who have sex with men	4,038	398 (9.9)	4,318	507 (11.7)	0.90 (0.79, 1.03)
Laboratory-confirmed infection at index visit	Yes	2,982	349 (11.7)	3,008	482 (16.0)	0.86 (0.75, 0.99)
	No	16,091	580 (3.6)	16,554	685 (4.1)	0.93 (0.84, 1.04)

[a]Includes gonorrhea, chlamydia, trichomoniasis (females only), syphilis (primary or secondary), or HIV infection.
[b]Males only.
[c]Results were calculated using Cox proportional hazards regression and are shown with Wald confidence intervals.
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which could introduce bias if provider knowledge of study condition affected decisions on which patients received STD screening during the observation period. For bias to have affected ascertainment of study outcomes, however, clinicians would have needed to know what condition patients were initially assigned to when providing care. We believe this scenario to be unlikely given that condition assignment was based exclusively on the date of the index visit and not on the date of or study condition present at subsequent clinic visits. Further, condition assignment was not recorded in the patient's clinic record. The fact that the proportion of patients in each condition who were infected with STD was perfectly balanced at the index visit (when condition assignment was most likely to be known to providers) suggests that the likelihood of such bias during follow-up was small.

These findings are also limited by the use of passive follow-up to ascertain incident STD outcomes, rather than active laboratory screening. The record-based approach used to identify new infections is efficient for studies in which large numbers of observations require follow-up; however, this approach cannot capture undetected asymptomatic infections or account for patient migration, and, as a result, may underestimate STD incidence. Nevertheless, despite the large sample size required for studying this low-intensity intervention, we were able to use laboratory-confirmed STD outcomes, as opposed to only behavioral or social psychological measures, to measure intervention impact, the importance of which has been well described [6,18,19]. The intervention also did not appear to alter care- or treatment-seeking behavior of patients assigned to the video intervention, as the same proportion of patients in both study arms returned to the STD clinic during the study period, irrespective of whether they were diagnosed with incident STD; this suggests minimal bias in our study design. Only one public STD clinic was located in each city, and return visits were documented for similar proportions of patients in each condition. Although we lacked information for individual records on factors such as whether partner notification and treatment services were accessed, the fact that patients in both study conditions encountered the same basic clinic services in alternating months—and were remarkably similar to each other—suggests that these issues cannot explain the finding of reduced STD risk associated with intervention exposure. These factors, taken together, suggest that the observed reduction in STD incidence was both real and likely to be an underestimate of the true effect.

Our study design also had several strengths. Compared with previous studies of behavioral interventions in STD clinics, this evaluation was conducted under actual clinic conditions rather than controlled study conditions. By incorporating our intervention into the natural waiting room environment, we directly observed the effectiveness of *Safe in the City* in reducing new infections among large populations of STD clinic patients. Because our evaluation included all clinic patients, our finding of reduced STD incidence is likely generalizable to patients at these clinics and likely to STD clinics with similar patient profiles. Additionally, our design did not require active consent and thus avoided many typical threats to external validity that are introduced by narrow eligibility criteria, low or differential participation rates across conditions, and the provision of financial incentives. Since patients were not actively enrolled in (and thus were likely unaware of) our evaluation of *Safe in the City* as a structural waiting room intervention, biases associated with

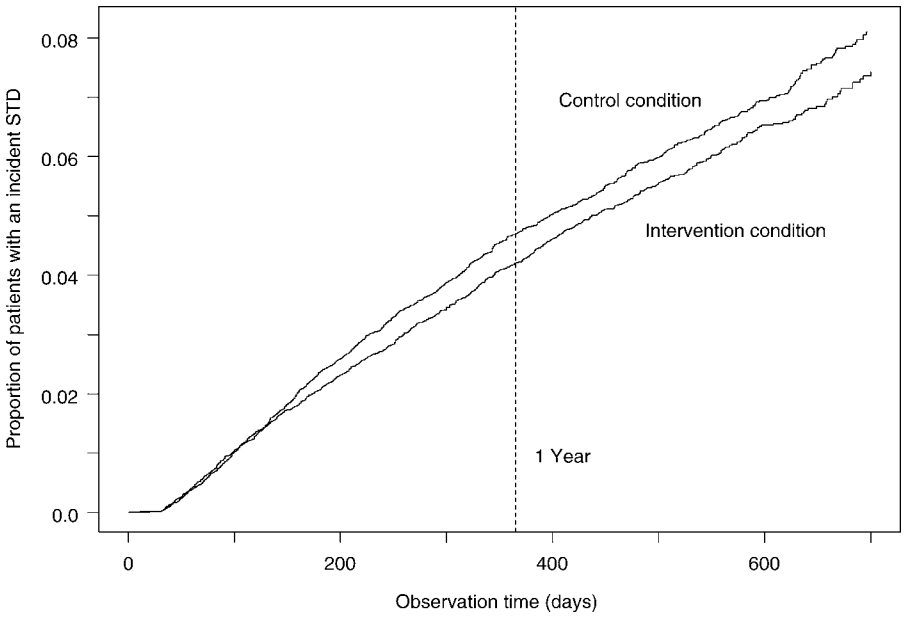

Figure 2. Laboratory-Confirmed Infection among Patients at Sexually Transmitted Disease Clinics in Three U.S. Cities, December 2003 through August 2005, by Study Condition
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study participation (e.g., Hawthorne effect) were eliminated. Further suggesting the generalizability of our findings, we note that several identified predictors of infection were the same as those reported in other studies of STD clinic populations (e.g., men who have sex with men, young age, and infection at the index clinic visit) [10,20–23].

Finally, we successfully designed a study to assess intervention effectiveness in a clinic waiting room environment, where individual random assignment was neither possible nor practical. Although our study was not individually randomized, by systematically allocating patients to study conditions in alternating blocks, we successfully balanced the key characteristics of patients in both study conditions in terms of all measured covariates, thus likely approximating the

Table 3. Factors Associated with Diagnosis of Incident Laboratory-confirmed Infection among Patients at STD Clinics in Three U.S. Cities, December 2003–August 2005, by Sex [a]

Characteristic	Category	Males ($n = 26,934$)		Females ($n = 11,623$)	
		Unadjusted Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI) [b]	Unadjusted Hazard Ratio (95% CI)	Adjusted Hazard Ratio (95% CI) [b]
Study condition	Intervention	0.87 (0.78, 0.96)	0.88 (0.80, 0.98)	1.06 (0.89, 1.25)	1.02 (0.86, 1.21)
	Control	Referent	Referent	Referent	Referent
Race/ethnicity	Black, non-Hispanic	1.76 (1.56, 2.00)	2.41 (2.11, 2.75)	4.29 (3.40, 5.42)	3.91 (3.09, 4.95)
	Hispanic	0.99 (0.87, 1.13)	1.17 (1.02, 1.34)	2.38 (1.86, 3.05)	2.20 (1.71, 2.83)
	Other/missing	1.10 (0.91, 1.33)	1.10 (0.91, 1.33)	1.53 (1.10, 2.14)	1.54 (1.10, 2.16)
	White, non-Hispanic	Referent	Referent	Referent	Referent
Age, y	<25	1.14 (1.02, 1.28)	1.42 (1.26, 1.61)	2.00 (1.68, 2.38)	1.87 (1.56, 2.23)
	≥25	Referent	Referent	Referent	Referent
Site	San Francisco	2.51 (1.85, 3.41)	2.16 (1.58, 2.94)	2.10 (1.32, 3.32)	2.93 (1.85, 4.66)
	Denver	1.88 (1.38, 2.57)	1.96 (1.44, 2.69)	2.79 (1.18, 4.39)	2.72 (1.72, 4.28)
	Long Beach	Referent	Referent	Referent	Referent
Sexual orientation [c]	Men who have sex with men	3.37 (3.04, 3.74)	3.90 (3.46, 4.39)	NA	NA
	Heterosexual	Referent	Referent	NA	NA
Laboratory-confirmed infection at index visit	Yes	3.70 (3.34, 4.11)	3.00 (2.70, 3.33)	3.24 (2.71, 3.89)	2.49 (2.06, 3.00)
	No	Referent	Referent	Referent	Referent

[a]Includes gonorrhea, chlamydia, trichomoniasis (females only), syphilis (primary or secondary), or HIV infection.
[b]Models adjusted for variables listed in the table. Results were calculated using Cox proportional hazards regression and are shown with Wald confidence intervals.
[c]Males only.
NA, not applicable.
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primary benefits obtained from randomization [24,25]. Given our aim to assess the real-world impact of the intervention for clinic populations, this study represents an experimental design that was among the most rigorous options for evaluating intervention effectiveness. Similar examples of designs with minimal bias have been noted by others [6,24,26].

In summary, we found that showing a brief informational and skills-building video intervention in STD clinic waiting rooms, without a counseling component, decreased new STDs among high-risk patients in three urban clinics. As has been shown with video-based health interventions (e.g., tobacco cessation and proper antibiotic use) in other settings [27–29], these interventions have the potential to reach large numbers of STD clinic patients efficiently and to be acceptable to clinic staff because they are easy to implement and inexpensive. Given that STD clinics account for only a minority of diagnosed infections [30], future research should evaluate the appropriateness, applicability, and effectiveness of video interventions in other settings serving at-risk populations, including family planning clinics, adolescent clinics, jails and detention centers, urgent care settings, and private clinic settings. Additional research could also focus on identifying the particular element(s) of video-based interventions (e.g., prevention messages regarding condom use, partner treatment, and/or partner communication, stimulation of patient communication with providers) that facilitate reductions in new infections among STD clinic populations, as was observed in this and other studies [9,10]. This information is critical for developing similar low-intensity interventions utilizing video, given that the cultural appeal of videos to patients may change over time [27]. Future research focused on how best to implement these types of video-based interventions within the infrastructure of high-volume clinics serving similar patient populations would prove both beneficial and useful.

Supporting Information

Text S1. Study Protocol

Found at doi:10.1371/journal.pmed.0050135.sd001 (133 KB DOC).

Text S2. CONSORT Checklist

Found at doi:10.1371/journal.pmed.0050135.sd002 (49 KB DOC).

Text S3. Description of the *Safe in the City* Video Intervention

Found at doi:10.1371/journal.pmed.0050135.sd003 (43 KB DOC).

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Editors' Summary

Background. In the US alone there are 19 million new cases of sexually transmitted diseases (STDs) every year. STDs are infections that pass between people during sexual activity (through semen, vaginal fluids, blood, or skin-to-skin contact). Some STDs are caused by bacteria (for example, chlamydia, gonorrhea, and syphilis). Others are caused by parasites (for example, trichomoniasis) or viruses (for example, herpes simplex virus and HIV). Symptoms vary among STDs but may include sores, unusual lumps and itching in the genital region, pain when urinating, and unusual genital discharge. While symptoms are generally more common in men than women, many STDs cause no symptoms. Untreated STDs are more serious for women and may include pelvic inflammatory disease (PID), ectopic pregnancy, infertility, and chronic pain. Bacterial and parasitic STDs can be cured with various drugs; STDs caused by viruses cannot be cured although they can be treated with antiviral drugs.

Why Was This Study Done? Several interventions have been developed to educate people at risk of infection about risky sexual behavior and to teach them the personal skills needed to avoid unsafe sex (for example, negotiation skills that help them persuade their partner to use a condom). Although these interventions reduce the incidence of STDs, they usually involve several sessions of individual or group counseling and are likely too complex and expensive to implement in busy STD clinics. In this study, the researchers ask whether a short video that contains key STD prevention messages can reduce the acquisition of new infections among patients who watch the video while sitting in the waiting room of an STD clinic (a "teachable moment" when people are likely to be receptive to messages about health risks).

What Did the Researchers Do and Find? The researchers developed a 23-minute soap-opera style video—"Safe in the City"—that contained three interwoven dramas about young people in various types of relationships negotiating safer sexual behavior, and two animation segments about condoms. The researchers showed this video (and displayed related posters) in the waiting rooms of three US publicly funded STD clinics every alternate month over a 20-month period. Nearly 20,000 patients were exposed to this intervention. Another 20,000 "control" patients who attended the clinics in the months when the video was not shown were exposed to a standard waiting room environment in which only leaflets about STDs and condoms were available. The researchers then reviewed medical records and STD surveillance registries to find out how many patients in each group developed laboratory-confirmed STD after their initial clinic visit. Their statistical analyses show that the intervention reduced the number of new STD diagnoses by nearly 10%. The intervention was most effective among patients who had had an STD at their first visit and among men, but did not appear to reduce the chances of women acquiring an STD.

What Do These Findings Mean? These findings suggest that showing a brief, carefully designed video in STD clinic waiting rooms might be a simple, effective way to reduce the incidence of STDs. More research is needed to discover which parts of the video—those that increase knowledge and perception of STD risk, those that promote positive attitudes toward condom use, or those that provide the necessary skills to negotiate safe sexual practices—are the most effective and why the video appeared to be more effective for some groups of patients than others. The intervention also needs to be tested in other types of clinics but if it works as well elsewhere as in the three study clinics, the widespread implementation of this low-cost, low-intensity waiting room intervention could produce a meaningful reduction in the incidence of STDs in the US and elsewhere.

Additional Information. Please access these Web sites via the online version of this summary at http://dx.doi.org/10.1371/journal.pmed.0050135.

- Information is available from Avert, an international AIDS charity, on sexually transmitted diseases
- The US Centers for Disease Control and Prevention provides detailed information about sexually transmitted diseases, including information about STD prevention (in English and Spanish)
- MedlinePlus also provides a list of links to information about sexually transmitted diseases (in English and Spanish)
- The MedlinePlus encyclopedia has a page on safe sex (in English and Spanish)
- The Safe in the CIty Study Group has a project-specific Web site that provides additional details about the intervention and a mechanism for ordering the video