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# The Effect of Motivational Interviewing-Based Counseling During Outpatient Provider Initiated HIV Testing on High-Risk Sexual Behavior in Rural Uganda

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## Abstract

Provider-initiated HIV testing and counseling (PITC) has rapidly expanded in many countries including Uganda. However, because it provides HIV prevention information without individualized risk assessment and risk reduction counseling it may create missed opportunities for effective HIV prevention counseling. Our objective was to assess the effect of a brief motivational interviewing-based intervention during outpatient PITC in rural Uganda compared to Uganda's standard-of-care PITC at reducing HIV transmission-relevant sexual risk behavior. We enrolled 333 (160 control, 173 intervention) participants in a historical control trial to test the intervention vs. standard-of-care. Participants received PITC and standard-of-care or the intervention counseling and we assessed sexual risk behavior at baseline and 3 and 6 months follow-up. The intervention condition showed 1.5–2.4 times greater decreases in high risk sexual behavior over time compared to standard-of-care ($p = 0.015$ and $p = 0.004$). These data suggest that motivational interviewing based counseling during PITC may be a promising intervention to reduce high-risk sexual behavior and potentially reduce risk of HIV infection.

## Resumen

Los servicios de pruebas y asesoramiento del VIH iniciadas por proveedores de cuidado de salud (PITC) se han expandido rápidamente en muchos países, entre ellos Uganda. Sin embargo, debido a que se proporciona información sobre la prevención del VIH sin evaluación del riesgo individual o asesoramiento para reducir el riesgo, esto puede crear oportunidades perdidas para el asesoramiento eficaz de prevención del VIH. Nuestro objetivo fue evaluar el efecto de una breve intervención de entrevista motivacional durante PITC para pacientes ambulatorios en la zona rural de Uganda en comparación con el estándar de atención durante PITC en Uganda para reducir

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comportamientos sexuales de riesgo para la transmisión del VIH. Incluimos a 333 (160 en el grupo de control y 173 en el grupo de intervención) participantes en un ensayo de control histórico para poner a prueba la intervención vs. estándar de atención. Los participantes recibieron PITC y el estándar de atención o el asesoramiento de intervención y se evaluó el comportamiento sexual de riesgo al inicio del estudio, 3 y 6 meses de seguimiento. La condición de intervención mostró 1.5 a 2.4 veces mayores disminuciones en el comportamiento sexual de alto riesgo sobre el tiempo en comparación con el estándar de atención ($p = 0.015$ y $p = 0.004$). Estos datos sugieren que el asesoramiento basado en entrevista motivacional durante PITC puede ser una intervención prometedora para reducir el comportamiento sexual de alto riesgo y potencialmente reducir el riesgo de infección por el VIH.

**Keywords**

HIV testing; Sexual risk behavior; Motivational interviewing; Uganda

## Introduction

Increasing access to and uptake of HIV testing and counseling is a critical component in the global response to the HIV epidemic, as testing serves as an entry point to treatment, care, and prevention services for HIV-infected individuals. In Uganda, a country with 7.3 % adult HIV prevalence [1], provider-initiated HIV testing and counseling (PITC) was adopted in the national policy in 2005 and has become standard-of-care in all health facilities [2]. PITC refers to HIV testing and counseling provided as a standard component of medical care, in contrast to “opt in” or voluntary counseling and testing (VCT). Despite some evidence for the potential for PITC to reduce high risk sexual behavior, the global movement to increase PITC came under scrutiny because of its decreased emphasis on the counseling component [3–6]. At the time the present study was implemented, guidelines for PITC recommended the provision of HIV prevention information as opposed to client-centered risk reduction counseling recommended for VCT [7, 8]. The reduced emphasis on HIV-risk reduction counseling as part of PITC, which is necessary for PITC to be part of routine clinical care, is justified through the rationale that HIV-infected individuals receive HIV-pre-vention risk-reduction counseling as part of HIV clinical care. However, in the PITC model, individuals who test negative for HIV do not receive individualized HIV risk reduction counseling unless they specifically seek it out, which could potentially contribute to missed opportunities for prevention. Given the worldwide scale up of PITC, it is important to create PITC models that are brief but effective at reducing HIV-transmission risk behaviors since PITC may be the first and only access many individuals have to HIV-prevention services [6].

There have been few interventions attempting to maximize the effect of PITC on HIV risk reduction published in the literature, and none to our knowledge that have been evaluated in resource-limited settings. Metsch et al. [9] reported mixed findings from a brief intervention with STD clinic patients in the United States (US). Their intervention involved brief patient-centered risk reduction pre-test counseling and they found intervention effects on rates of unprotected sex with non-primary partners but not the total number of unprotected sex acts.

Given the time constraints of the PITC model, the challenge is figuring out a way to include effective risk reduction counseling without increasing the time required for PITC. Multiple meta-analyses have demonstrated brief client-centered counseling using motivational interviewing [10–12] techniques to be effective in health behavior change interventions targeting a variety of health behaviors [13, 14] including reducing high risk sexual behavior among people living with HIV [15]. These data suggest that it may be promising to incorporate MI during PITC. Motivational interviewing consists of a set of empirically supported interpersonal communication techniques designed to produce rapid, internally motivated changes in health-related behaviors (e.g., [10–12]). The goal of motivational interviewing is to mobilize the patient's own resources to effect change rather than to prescribe a particular course of action [10].

Drawing on the literature on the effectiveness of brief motivational interviewing counseling interventions, it may be possible to restructure the approach used during PITC to fully utilize the waiting time period for the rapid test results to deliver critical and effective prevention counseling with negligible increase in total time required which makes the intervention sustainable in resource-limited health facilities. Using this approach, this study tested a brief intervention using motivational interviewing techniques implemented during outpatient PITC in rural Uganda and compared that with Uganda's standard-of-care PITC to assess the effect on HIV risk-relevant sexual behavior. We hypothesized that the intervention would be more effective at reducing self-reported high risk sexual behavior than standard-of-care PITC services. We use the term 'high risk sexual behavior' to refer to unprotected sex acts with HIV discordant or unknown HIV status partners, reflecting potential risk of HIV transmission from the participant's perspective.

## Methods

### Study Setting

The study was conducted at Gombe General Hospital, a public rural 100-bed hospital in Butambala District, Uganda. Butambala district is an exclusively rural district with a population of over 100,000 in an area of approximately 270 $mi^2$ located 2 hours from the capital of Kampala. The 2011 AIDS Indicator Survey found HIV prevalence in the central region, in which Butambala is located, to be approximately 10.6 % with only 40 % of those who are HIV infected being aware of their status [1].

### Study Design

We assessed the effect of brief motivational interviewing [10, 12] based counseling during PITC (intervention) versus standard-of-care PITC (control) on high risk sexual behavior, which we defined as unprotected sex with an HIV discordant or unknown status partner. The study design was a historical control trial with a pretest from each group. This study design was employed to minimize the potential for contamination in a single site intervention trial since a multi-site trial was not feasible with the available funding. We enrolled participants in the control group and collected data before participants received standard-of-care PITC and follow-up data approximately 3 and 6 months later. After all control group data was collected, we enrolled a separate set of participants in the intervention group, collected data

before participants received PITC with motivational interviewing-based counseling, and follow-up data approximately 3 and 6 months later. Starting the intervention after all control group data was collected prevented a control condition participant from being exposed to the intervention if he/she went for repeat HIV testing at the same outpatient clinic during the 6 month follow up period. Participants, but not study staff, were blinded to study condition assignment; however, we did not assess if unblinding occurred.

## PITC Provider Training

At the Gombe Hospital outpatient clinic, as at many outpatient clinics in Uganda, laboratory technicians are among the primary "providers" of PITC. As such, all laboratory technicians, like nurses and other providers, undergo HIV counseling and testing training according to the Ugandan Ministry of Health (MOH) PITC protocol [16]. To further ensure equivalence in training across the laboratory technicians, we provided refresher training to the laboratory technicians on the Ugandan MOH PITC protocol. Following the completion of data collection from the control group, we trained the laboratory technicians to deliver the brief motivational interviewing-based counseling in a 4 day criterion based training. This training included training in the intervention steps as well as the principles and "spirit" of motivational interviewing: supporting self-efficacy, rolling with resistance, developing discrepancy, collaborating rather than confronting, embracing ambivalence to change, acknowledging clients' personal choice, eliciting the clients' ideas and motivation to change, recognizing that clients are the expert on themselves, and practicing reflective listening [10, 12].

## Recruitment and Eligibility Criteria

A research assistant recruited participants from the outpatient clinic at Gombe Hospital by non-systematically approaching individuals in the outpatient waiting room. The research assistant briefly described the study, verbally determined eligibility from those interested in participating, offered participation to those who were eligible, and obtained written informed consent. Participant eligibility criteria were: attending the outpatient clinic and eligible for PITC, residing within 20 km of the hospital, age 18 years or older, not having had an HIV test within the prior 6 months, sexually active in the prior month, not attending the clinic specifically for HIV testing, not pregnant, and never tested positive for HIV. Only one member of a couple was allowed to participate. We purposely recruited approximately equal numbers of men and women across and between study conditions to help minimize gender bias from the non-randomized design.

For the control condition we enrolled 160 participants from April to September 2010 and for the intervention condition we enrolled 173 participants from April to October 2011. Institutional review boards at Makerere University School of Public Health, the University of Connecticut Health Center, and Rhode Island Hospital, as well as the Uganda National Council for Science and Technology, approved the study protocol.

## Procedures

Participants received pretest information about the routine HIV test, completed a one-on-one structured interviewer-administered computer-assisted personal interview (CAPI) in

Luganda using QDS software [17] in the on-site study office, were given an appointment date for 3-month and 6-month follow-up interviews, and then received HIV rapid testing according to Ministry of Health guidelines [16].

For the control group, counselors provided standard-of-care information-based counseling along with the test results in a private room once the HIV test results were ready. Counseling followed the Ugandan MOH guidelines [16] and lasted an estimated 5–10 min.

In a private room in the outpatient clinic participants in the intervention group received individual brief motivational interviewing-based counseling lasting approximately 10–15 min immediately after the HIV test while awaiting test results. The waiting time can serve as a “teachable moment” when patients are considering the possibility that they may be HIV-infected. The intervention counseling structure and content was adapted from the efficacious OPTIONS intervention, a brief client-centered sexual risk reduction intervention for HIV-infected patients [18–20]. The intervention is based upon the Information Motivation Behavioral Skills model of health behavior change [21] and uses motivational interviewing techniques [10, 12].

The adapted single-session intervention protocol consisted of 8 brief steps: [1] introduce the topic of safer sexual behavior and HIV risk, [2] assess the patient’s HIV risk behavior, [3] summarize high risk behaviors and ask the patient to choose one on which to focus, [4] assess how important it is to the patient to change this behavior and how confident the patient feels he/she can change this behavior, [5] explore why he/she is confident that he/she can change this behavior, [6] summarize the patient’s responses and discuss strategies to increase the patient’s confidence, [7] help the patient choose a plan to change this behavior, and [8] document the plan on an action plan form and give to the patient. Counselors documented the completion of intervention steps on protocol forms, recording details about 5 of the 8 steps (steps 2, 3, 4, 7, and 8) for which brief descriptive information could be documented for process evaluation. Next the counselor told the participant his/her results and reviewed the participant’s plan for changing behavior and if appropriate helped the participant to modify the plan based on the test results.

If a participant tested positive for HIV in either group the counselor discussed available HIV care and support and provided the participant a referral to the HIV clinic.

## Measures

We assessed fidelity to the control condition MOH PITC protocol by audio recording a subset of counseling sessions in the control group, transcribing and translating them into English, and then coding them to determine how many of the protocol steps were completed. We focused on the steps relevant to HIV risk reduction which included: discussing risk behaviors, providing risk reduction information and the opportunity for the client to ask questions, discussing the importance of getting partners tested, and partner referral for HIV testing. The protocol for those who test positive for HIV also includes emphasizing HIV prevention behaviors.

We assessed fidelity to the intervention protocol by analyzing the number of documentable intervention steps (5 of the 8 for which meaningful information could be documented) completed from the protocol forms that the lab technicians filled in. The remaining three steps of the protocol could not logistically be documented in such a way to have confidence that the step was completed, either because there was no participant response to document or documenting the information would require too much detail to be feasible in the brief intervention. In addition we collected audio recordings of a subset of intervention counseling sessions. The audio recordings were transcribed, translated, and coded.

Baseline and follow-up questionnaires included participant socio-demographics (baseline only), HIV testing history, circumcision status (for men), and detailed questions using timeline follow-back techniques [22] about their three most recent sexual partners including: partner's HIV testing history and results, the number of times they had sexual intercourse and condom use per coital act in the prior 3 months with each partner. Household wealth was measured using questions about what their home was constructed of and if it had electricity. We created three categories representing lowest to highest wealth.

Our primary outcome was high risk sexual behavior which was defined as unprotected sex with an HIV serodiscordant or unknown status partner. We operationalized the outcome as the proportion of sexual acts that were high risk and the total number of high risk sexual acts.

## Statistical Analysis

We used an intent-to-treat analysis in which analysis of intervention effects was based on the condition to which participants were assigned rather than on actual intervention received. Individuals were the unit of analysis. Before assessing intervention outcomes, we examined whether there were pretest differences and differential attrition between the two study conditions using analyses of variance (ANOVA) for continuous variables, Chi square analyses for categorical variables, and generalized linear models with a Poisson distribution for count variables. Next, we conducted univariate analyses to determine if any socio-demographic factors were associated with either of the outcomes. Socio-demographic variables for which there were pretest differences between the groups or those which correlated with either outcome were included in intervention outcome analyses. We performed all analyses using SPSS version 20 [23].

To assess intervention outcomes, the outcome measures of high risk sexual behavior were modeled as a function of condition, time (0, 1, 2), gender, HIV test results, and condition × time interaction. We conducted intent-to-treat analyses using generalized estimating equations (GEE) with an autoregressive correlation structure to account for correlation from longitudinal data. This approach has been used in intervention studies with similar outcomes [24–26]. In modeling the outcome of the proportion of sex events that were risky, we used a binary logistic model to model the proportion of sex events that were high risk relative to the total number of sex events. For the outcome of the number of high risk sexual events, we used a Poisson loglinear model which models the number of high risk sexual events reported including zero for those who reported either not having sex or having no high risk sex. We

also tested if HIV test results moderated a condition or time effect or the condition × time interaction.

## Results

For the control condition, we screened 609 outpatients at Gombe Hospital; 66 declined to participate, 449 were ineligible, and 160 were enrolled. The reasons for ineligibility were: lived more than 20 km from clinic (27 %), not sexually active in prior month (20 %), already tested positive for HIV (19 %), tested for HIV within the prior 6 months (14 %), came specifically seeking HIV testing only (14 %), pregnant (4 %), and under 18 years of age (2 %).

For the intervention condition, we screened 533 outpatients at Gombe Hospital; 72 declined to participate, 360 were ineligible, and 173 were enrolled. The reasons for ineligibility were: not sexually active in prior month (32 %), lived more than 20 km from the clinic (27 %), tested for HIV within the prior 6 months (15 %), came specifically seeking HIV testing only (12 %), already tested positive for HIV (7 %), pregnant (4 %), under 18 years of age (4 %), and participated in the control condition (<1 %). Of the 173 enrolled in the intervention, 10 did not receive the intervention because the counselor was not present for duty.

Participant demographic and HIV risk-relevant characteristics at baseline are presented in Table 1. Approximately half of the sample in each study condition was female (51.2 % standard-of-care, 49.7 % intervention). Average age was 33 in both conditions. The majority of the sample was married (87.5 % standard-of-care, 86.1 % intervention) and over half had primary level education or less (59.4 % standard-of-care, 67.6 % intervention). About 40 % reported being employed throughout the year (41.9 % standard-of-care, 36.4 % intervention). Results of tests for differences between study conditions are reported below and in Table 1.

### Attrition Analyses

Of the 333 (160 control, 173 intervention) enrolled participants, 292 (136 control, 156 intervention) completed the 3 month follow up and 303 (145 control, 158 intervention) completed the 6 month follow up. Three hundred and seventeen participants (151 control, 166 intervention) completed at least one follow up interview and were included in the analyses yielding 925 data points (440 control, 485 intervention). There was no differential attrition by study condition, $\chi^2 = 0.88$, $p = 0.35$. Those who previously had an HIV test were less likely to be lost to follow-up, $\chi^2 = 5.19$, $p = 0.02$. Those who tested positive for HIV were more likely to be lost to follow up, $\chi^2 = 12.68$, $p < 0.001$. However, if we excluded deaths, the difference became smaller, $\chi^2 = 6.41$, $p = 0.01$. There were no differences in attrition based on study outcomes, socio-demographics, nor any of the other potential moderators of intervention effects.

### Standard-of-Care Implementation Fidelity

Of the 62 standard-of-care post-test counseling sessions audio recorded with participants who tested negative for HIV, an average of 2.2 of the 4 risk reduction relevant steps were completed. Of the eight standard-of-care post-test counseling sessions audio recorded with

participants who tested positive for HIV, an average of 2 of the 5 risk reduction counseling steps were completed. Sessions lasted 7.09 min on average (range 2–27).

### Intervention Implementation Fidelity

Ten of the protocol forms were missing because the counselor was not present for duty and the client did not receive the intervention. Of the 163 protocol forms collected, 156 (95.7 %) assessed the client's risk behavior, 133 (81.6 %) summarized the client's risk behaviors and helped client choose one on which to focus, 132 (81.0 %) assessed the client's rating of how important it was to them to change their behavior and assessed how confident they were they could change their behavior, 131 (80.4 %) helped the client choose a specific plan of action to change behavior to be safer, and 117 (71.8 %) gave the action plan to the client to take home and the client took the action plan (five clients did not want to take the action plan home). One hundred and nine (66.9 %) of the protocol forms showed all 5 of the documentable steps completed, 17 (10.4 %) showed 4 of the 5 steps being completed, 9 (5.5 %) showed 3 steps completed, 28 (17.2 %) showed one or two steps completed. Intervention protocol fidelity was much higher for those reporting engaging in potential HIV risk behavior: for those who reported no risk in the counseling session (14.4 %, n = 48), an average of 2.96 steps (out of 5) were completed vs. an average of 4.58 (out of 5) completed for those reporting risk, $t(161) = 7.25$, $p < 0.001$). Of the 18 intervention counseling sessions audio recorded an average of 4.7 of the 8 steps were completed. Over half (56 %) completed five or more steps. From the audio recording data, sessions lasted 12.2 min on average (range 3–28).

### Baseline Equivalence Between Conditions

In Table 1 we report the baseline characteristics of participants by study condition. Study conditions differed only on wealth and employment. We therefore included these variables in our outcome analyses.

As a final step in preparation for our outcome analyses we tested all socio-demographic variables as predictors of the outcomes. The only variables that were related to the outcomes were marital status and gender. Therefore those variables were also included in our outcome analyses.

### Proportion of Sex Acts that were High Risk

Analyses for the outcome of the proportion of sex acts that were high risk included 893 data points (417 control, 476 intervention). Thirty two data points were excluded because participants reported zero sex acts and thus could not be included in an outcome variable representing a proportion. There were no differences in the proportion of sex acts that were high risk based on any of the potential confounders (wealth, employment, gender, HIV test result, marital status). In intention-to-treat analysis there was a statistically significant interaction between time and study condition ($\chi^2$ 8.93, df = 2, $p = 0.012$) which, as presented in more detail in Table 2, showed that while both study conditions decreased the proportion of sex acts that were high risk, the intervention condition showed statistically significant greater decreases over time. Specifically, both the control and intervention groups decreased the proportion of sex acts that were high risk between time 0 and time 1, but

between time 1 and time 2 the control condition increased the proportion of sex acts that were high risk while the intervention condition decreased the proportion of sex acts that were high risk. Both conditions had statistically significant decreases between time 0 and time 2, but the amount of decrease was significantly greater in the intervention condition. None of the covariates nor HIV test results significantly moderated the time by condition interaction. There were no differences in change over time in the intervention group as a function of the number of intervention counseling protocol steps that were completed ($\chi^2$ 0.51, df = 2, $p = 0.77$).

### Number of High Risk Sex Acts

All 925 data points (440 control, 485 intervention) were included in this analysis including participants reporting zero sex acts. Irrespective of study condition and time, women reported fewer high risk sex acts compared to men [$\chi^2$ 5.80, $p = 0.016$, Exp$\beta$ 0.77 (0.63–0.95)] and married participants reported more high risk sex acts compared to unmarried participants [$\chi^2$ 41.01, $p < .001$, Exp$\beta$ 2.99 (2.14–4.18)]. No other significant effects of the covariates on the outcome were found.

As shown in more detail in Table 2, in intention-to-treat analysis there was a significant interaction between time and study condition ($\chi^2$ 8.67, df = 2, $p = 0.013$) which showed the change over time was greater for the intervention group. Specifically, the control group decreased the number of high risk sex acts between time 0 and time 1, but then increased between time 1 and time 2, and the time 2 number of high risk sex acts was not significantly lower than time 0. The intervention group showed continued decreases in the number of high risk sex acts through the last follow-up. None of the covariates nor HIV test results significantly moderated the time by condition interaction. There were no differences in the effect of the intervention over time on the number of high risk sex events based on the number of intervention counseling protocol steps that were completed ($\chi^2$ 1.96, df = 2, $p = 0.37$).

## Discussion

At this rural Ugandan public health facility, consistent with our hypothesis, brief motivational interviewing-based counseling during PITC was more effective than standard-of-care PITC at reducing both the quantity of high risk sexual behavior and the proportion of sex acts defined as high risk. It was notable, however, that the standard-of-care condition showed significant decreases in the proportion of sex acts that were high risk over time. This is consistent with a recent study from urban Uganda which showed modest decreases in the percentage of participants who reported high risk sexual behavior between baseline and 12 month follow-up among participants who received standard-of-care PITC [27]. Even though the standard-of-care counseling prompted decreases in high risk sexual behavior the durability of this effect is questionable since this condition showed increases in risk between the second and third follow-up. The intervention group, on the other hand, continued to decrease risk through the final follow-up. Both conditions received brief counseling; however, those in the intervention condition received motivational interviewing-based counseling tailored to their specific situation. With the help of the counselor, motivational

interviewing intervention participants were encouraged to set goals to reduce their risk and conceived of ways they could overcome potential barriers to reaching their goals. Consistent with a meta-analysis, [28] we speculate that “change talk” may be a mechanism by which motivational interviewing helped patients change behavior—since it is not usually a component of HIV counseling protocols. Although this study was not a randomized clinical trial, it adds to the growing literature on the effectiveness of motivational interviewing-based sexual risk reduction counseling in sub-Saharan Africa [18–20, 24].

It is also notable that the intervention seemed to be effective for both those who tested negative for HIV and those who tested positive for HIV. Previous research has found HIV testing in general to be less effective at reducing risk behavior among those who test negative [29–31]. While those who test positive and link to care have additional opportunities for HIV risk reduction counseling, those opportunities are limited for those who test negative. Therefore, our results supporting the effectiveness of the intervention among those who tested negative for HIV demonstrate that it is feasible, and may be beneficial, to include brief HIV risk reduction counseling during PITC. Moreover, this provides essential access to HIV prevention counseling for those who test negative for HIV and would be otherwise unlikely to receive this counseling.

## Limitations

Despite the encouraging results, our study has a number of limitations. Participants were not randomized, we had a small sample size, and used self-reported outcomes. The historical control study design does not control for events that may have occurred during the study that could have differentially affected study conditions. Reasons for ineligibility were somewhat different by study condition. It is possible that HIV prevention social marketing or other things may have been different between the two recruitment time periods; however we are not aware of specific HIV prevention communications or other campaigns that could have affected behavior. Selection bias is a limitation since we did not randomly select potential participants. Under-reporting of risk behavior may have occurred although it would likely be the same magnitude in both study conditions since the assessment of behavior was identical in both study conditions. The follow-up period was short (6.4 months), therefore, it is unknown how long the observed risk reduction may be maintained. Over half of the sample in each condition were individuals who were at the outpatient clinic because they were accompanying an ill child or family member. This limits the generalizability of the findings specifically to individuals seeking outpatient care but does not change the generalizability to populations receiving PITC in Uganda, since individuals accompanying family members would also be eligible to receive PITC. The control and intervention groups differed at baseline on employment and wealth, which were controlled for in the models testing intervention effects; however, this further reflects weaknesses in the non-randomized design. The intervention was not implemented with all participants in the intervention condition which reflects the realities of service delivery in public health facilities in resource limited settings. These delivery challenges also may affect the success of the intervention in non-research settings. The intervention session was about 5 min longer on average than the standard-of-care which also may lead to delivery challenges in non-research settings. However, we did not obtain data on duration for every session, only those which were audio

recorded. Intervention fidelity was moderately high and similar to other implementations of this type of intervention [24, 32]. Our slightly lower fidelity may be due to that we used existing clinic staff, rather than more highly trained research personnel, to deliver the intervention. Because of concerns about confidentiality for audio recordings we did not label them with participant ID numbers so we were unable to compare audio recordings of intervention counseling sessions to the completed protocol forms to examine concordance. However, the fact that we observed intervention effects on risk behavior, even though the intervention was not implemented with 100 % fidelity to protocol and that we used existing clinical staff, suggests that similar effects are likely to be observed if the intervention was implemented in non-research settings. The findings may generalize to similar resource limited settings especially since the intervention was delivered by existing health facility staff who are the usual providers of HIV testing in the context of a busy outpatient clinic. However, the generalizability is limited by the short follow-up period and non-randomized sampling method.

Notwithstanding the limitations, our data suggest that brief motivational interviewing-based counseling during PITC may be a promising approach for helping patients reduce HIV transmission-relevant sexual risk behavior. Future research is needed to test this intervention in a randomized controlled trial to examine its effects on high risk sexual behavior and, more importantly, on HIV seroconversion among those who initially tested negative for HIV. In addition, further research could potentially expand the intervention to address other steps in the HIV care continuum, such as linkage to care and treatment. While this intervention was part of PITC, which is a key component of efforts to increase the percentage of people with HIV who know their status, in light of the UNAIDS 90 % diagnosed, 90 % on treatment, and 90 % virally suppressed by 2020 goals [33], optimal linkage to care is also crucial to the wider goal to end the HIV epidemic.

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## Table 1

Descriptive statistics at baseline and pretest of equivalence between study conditions

| | Standard-of-care (n = 160) | Intervention (n = 173) | Test of pretest equivalence between conditions |
|---|---|---|---|
| Female | 82 (51.2 %) | 86 (49.7 %) | $\chi^2 = 0.08$, $p = 1.78$ |
| Mean age (range) | 33.49 (20–58) | 33.57 (21–79) | $F_{(1,332)} = 0.01$, $p = 0.94$ |
| Marital status | | | $\chi^2 = 0.14$, $p = 0.71$ |
| Married | 140 (87.5 %) | 149 (86.1 %) | |
| Not married | 20 (12.5 %) | 24 (13.9 %) | |
| Education | | | $\chi^2 = 4.61$, p = 0.20 |
| No formal education | 7 (4.4 %) | 9 (5.2 %) | |
| Primary | 88 (55.0 %) | 108 (62.4 %) | |
| Secondary | 45 (28.1 %) | 42 (24.3 %) | |
| Tertiary or > | 20 (12.5 %) | 14 (8.1 %) | |
| Employment | | | $\chi^2 =$ **8.45, p = 0.04** |
| Never | 20 (12.5 %) | 18 (10.4 %) | |
| Once in a while | 49 (30.6 %) | 43 (24.9 %) | |
| Part of the year | 24 (15.0 %) | 49 (28.3 %) | |
| Throughout the year | 67 (41.9 %) | 63 (36.4 %) | |
| Household wealth | | | $\chi^2 =$ **5.62, p = 0.06** |
| Lowest | 34 (21.3 %) | 50 (28.9 %) | |
| Middle | 94 (58.8 %) | 103 (59.5 %) | |
| Highest | 32 (20.0 %) | 20 (11.6 %) | |
| Previous HIV test | 136 (85.0 %) | 140 (80.9 %) | $\chi^2 = 0.97$, $p = 0.33$ |
| Tested HIV positive | 17 (10.6 %) | 15 (8.7 %) | $\chi^2 = 0.36$, $p = 0.55$ |
| Male participants circumcised | 34 (43.6 %) | 35 (40.2 %) | $\chi^2 = 0.79$, $p = 0.37$ |
| Mean number of sex acts in prior 3 months (SD) | 20.79 (14.59) | 21.87 (17.56) | $\chi^2 = 2.18$, $p = 0.14$ |
| Mean number of high risk sex acts in prior 3 months (SD) | 14.91 (14.33) | 15.99 (16.41) | $\chi^2 = 0.74$, $p = 0.39$ |
| Percentage of sex acts that were high risk in prior 3 months (SD) | 73.7 % (41.2) | 72.8 % (42.0) | $F_{(1324)} = 0.08$, $p = 0.76$ |

In this sample sex acts refer to vaginal sexual intercourse. High risk sex acts refer to unprotected sex with partners of unknown or HIV serodiscordant status

Values in bold indicate $p < 0.10$ and which variables were subsequently included as covariates in intervention outcome analyses

## Table 2

Intervention versus standard-of-care over time for the proportion of sex acts that were high risk and the number of high risk sex acts

| Outcome measure | HIV negative | | | HIV positive | | | Time effect within condition Time 0 vs. Time 2 | Time effect between conditions |
|---|---|---|---|---|---|---|---|---|
| | Time 0 | Time 1 | Time 2 | Time 0 | Time 1 | Time 2 | | |
| Proportion of sex acts that were high risk[a] | | | | | | | | At time 1: adjOR 0.86, 95 % CI (0.41–1.76), $p = 0.67$<br>At time 2: **adjOR 0.41, 95 % CI (0.20–0.84), p = 0.015** |
| Intervention | 73.74 % | 49.51 % | 38.28 % | 83.89 % | 64.53 % | 53.51 % | **adjOR 0.22, 95 % CI (0.13–0.37), p < 0.001** | |
| Standard-of-care | 72.41 % | 51.76 % | 58.40 % | 82.97 % | 66.56 % | 72.26 % | **adjOR 0.49, 95 % CI (0.30–0.79), p = 0.004** | |
| Mean number of high risk sex acts per person[a,b] | | | | | | | | At time 1: adjIRR 0.89, 95 % CI (0.64–1.27), $p = 0.53$<br>At time 2: **adjIRR 0.59, 95 % CI (0.42–0.85), p = 0.004** |
| Intervention | 17.79 | 10.93 | 9.34 | 14.29 | 8.78 | 7.51 | **adjIRR 0.52, 95 % CI (0.40–0.69), p < 0.001** | |
| Standard-of-care | 15.61 | 10.68 | 13.69 | 12.54 | 8.58 | 11.00 | adjIRR 0.87, 95 % CI (0.69–1.10), p = 0.254 | |

Data are shown separately for HIV negative and HIV positive participants for illustrative purposes, however, HIV results did not modify the intervention effect. In this sample sex acts refer to vaginal sexual intercourse. High risk sex acts refer to unprotected sex with partners of unknown or HIV serodiscordant status. Time points separated by an average of 3.2 months

*IRR* incident rate ratio, *OR* odds ratio, *adj* adjusted

[a] Calculated from model-based estimates accounting for all other variables in the model

[b] Mean number of high risk sex acts per person during the prior 3 months