

# Outcomes of a randomized, controlled community-level HIV prevention intervention for adolescents in low-income housing developments

Kathleen J. Sikkema<sup>a,b</sup>, Eileen S. Anderson<sup>c</sup>, Jeffrey A. Kelly<sup>b</sup>,  
Richard A. Winett<sup>c</sup>, Cheryl Gore-Felton<sup>b</sup>, Roger A. Roffman<sup>d</sup>,  
Timothy G. Heckman<sup>b</sup>, Kristi Graves<sup>c</sup>, Raymond G. Hoffmann<sup>b</sup> and  
Michael J. Brondino<sup>b</sup>

**Objectives:** Youth are increasingly at risk for contracting HIV infection, and community-level interventions are needed to reduce behavioral risk.

**Design:** A randomized, controlled, multi-site community-level intervention trial was undertaken with adolescents living in 15 low-income housing developments in five US cities.

**Methods:** Baseline ( $n = 1172$ ), short-term follow-up ( $n = 865$ ), and long-term follow-up ( $n = 763$ ) risk assessments were conducted among adolescents, ages 12–17, in all 15 housing developments. The developments were randomly assigned in equal numbers to each of three conditions: experimental community-level intervention (five developments); 'state-of-the-science' skills training workshops (five developments); and, education-only delayed control intervention (five developments).

**Results:** At long-term follow-up, adolescents living in the housing developments receiving the community-level intervention were more likely to delay onset of first intercourse (85%) than those in the control developments (76%), while those in the workshop developments (78%) did not differ from control condition adolescents. Adolescents in both the community-level intervention (77%) and workshop (76%) developments were more likely to use a condom at last intercourse than those in control (62%) developments.

**Conclusions:** Community-level interventions that include skills training and engage adolescents in neighborhood-based HIV prevention activities can produce and maintain reductions in sexual risk behavior, including delaying sexual debut and increasing condom use.

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**Keywords:** HIV/AIDS, prevention, adolescents, community intervention

## Introduction

HIV/AIDS has significantly impacted youth worldwide. More than half of those newly infected with HIV are

between 15 and 24 years old, and the majority of young people are infected sexually [1,2]. Numerous studies have established the efficacy of cognitive-behavioral group interventions to promote reductions in sexual risk

From the <sup>a</sup>Yale University School of Medicine and Centre for Interdisciplinary Research on AIDS (CIRA), New Haven, Connecticut, the <sup>b</sup>Medical College of Wisconsin, Milwaukee, Wisconsin, the <sup>c</sup>Virginia Polytechnic Institute and State University, Blacksburg, Virginia, and the <sup>d</sup>University of Washington, Seattle, Washington, USA.

Correspondence to Kathleen J. Sikkema, PhD, Department of Epidemiology and Public Health, Yale University, 60 College Street, P. O. Box 208034, New Haven, CT 06520-8034, USA.

E-mail: kathleen.sikkema@yale.edu

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behavior among adolescents [e.g., 3–8]. Such programs can produce short-term change in risk-related psychosocial, attitudinal and skills domains, and initial reductions in sexual risk behavior [9]. However, there is less evidence that health behavior changes remain durable in the absence of environmental and normative supports for sustained change.

Whereas most HIV prevention trials have involved youth in mid to late adolescence, few have targeted younger adolescents [5,10–14]. Findings across these studies are equivocal and effects differ by gender [10,11,14], especially with regard to long-term effects. A meta-analysis of the effectiveness of school-based sexual abstinence programs indicated that most studies did not employ research designs sufficiently rigorous to provide conclusive evidence on effects, which tended to be small [15].

Cognitive-behavioral interventions that focus primarily on the individual rather than the social environment may have limited long-term effectiveness, especially if peer norms, modeling influences, and reinforcement do not also function to support individual behavior change efforts. Interventions designed not only to change the behavior of individuals, but also the social networks and communities that reinforce the risk avoidance efforts of population members, are more likely to be effective [16].

Community-level interventions to prevent HIV have been successful with gay men [17,18], inner-city women [19,20], injection drug users [21], and other populations at elevated risk for HIV [22]. However, few have specifically targeted adolescents, especially those diverse in ethnicity and age. Inner city housing developments offer a relevant setting for community interventions for at-risk adolescents.

The purpose of this research was to examine whether the effects of HIV prevention efforts are stronger and better maintained when they target not only change in individual risk-reduction beliefs and skills, but also change in the social and peer normative environment [23]. To do so, a community intervention was designed to: (1) assist adolescents in developing the initial skills to enact change; and (2) systematically provide sustained modeling, peer norm and social reinforcement supports for maintaining the avoidance of HIV risk behavior. If this formulation is correct, adolescents in communities that receive the community-level intervention should *achieve and maintain* lower levels of HIV risk behavior (i.e., lower rates of initiation of sexual intercourse and greater condom use at last intercourse) in comparison with communities whose adolescent members are exposed only to skills training workshops (and might achieve initially lower levels of risk behavior) or to communities where adolescents receive HIV education alone.

## Methods

### Settings and participants

This research was conducted between 1998 and 2000 in 15 low-income housing developments in Milwaukee and Racine, Wisconsin; Roanoke, Virginia; and Seattle and Tacoma, Washington. Housing authority records were reviewed to identify developments with similar tenant characteristics, including adolescents' age and gender. Five sets of three housing developments, generally similar in size and ethnicity of residents, were identified in each of the three urban areas (two sets each in Wisconsin and Washington, and one set in Virginia). Each development had 56–350 adolescents in the 12–17 years age range, all were located in urban areas with high rates of poverty, sexually transmitted diseases (STDs), and drug use, were generally representative of housing developments in the US, and were located 2 or more miles apart to minimize the possibility of contamination across conditions.

### Baseline assessment of risk behavior

All households with adolescents were informed of the study. Recruitment involved contact with parents or guardians to obtain consent, followed by recruitment (and assent) of adolescents. Adolescents received US\$ 20 for assessment completion.

Participants completed a demographic survey (age, gender, race/ethnicity, family composition) followed by an audio computer-administered survey in settings in or near the developments. The 'Teen Health Survey' assessed HIV risk behaviors and psychosocial characteristics [23]; scale development and items for all measures have been described in detail elsewhere [24]. Skip-patterns were utilized to avoid posing sexually-oriented questions to adolescents who were not sexually active or had never experienced certain sexual activities.

#### *Partner status and sexual behavior*

Adolescents were asked if they currently had a boyfriend/girlfriend, if they had a boyfriend/girlfriend in the past year, and if they ever had intercourse. If so, they were asked age at first intercourse, condom use at last intercourse, number of male and/or female partners in the past year and past 3 months, and whether they ever had an STD.

#### *Substance use behaviour*

Adolescents were asked about their use of tobacco, alcohol, illegal drugs, or injection drugs in the past 3 months.

#### *Risk-reduction knowledge scale*

Practical understanding of HIV risk behavior was assessed using a 12-item true-false scale ( $\alpha = 0.61$ ).

#### *Risk-reduction intentions*

Intention to perform HIV risk-reduction behaviors was assessed with a 13-item scale ( $\alpha = 0.81$ ).

### Risk-reduction self-efficacy

Rating of certainty to be able to perform 17 specific risk-reduction skills and behaviors, including avoidance and refusal behaviors (*Total risk-reduction self-efficacy*;  $\alpha = 0.87$ ). Two factor-based subscales were used: *Condom use self-efficacy* (five items,  $\alpha = 0.72$ ) and *Abstinence self-efficacy* (five items,  $\alpha = 0.78$ ).

### Risk-reduction outcome expectations

Two scales assessed physical, social, and self-evaluative expectations for risk-reduction behavior and skills: *Abstinence outcome expectations scale* (12 items,  $\alpha = 0.76$ ) and *Condom use outcome expectations scale* (10 items,  $\alpha = 0.72$ ).

### Risk-reduction behavioral skills

A 21-item scale assessed skills for enacting HIV risk-reduction behavior performed in the past 3 months ( $\alpha = 0.86$ ). Items were designed to assess communication, abstinence, condom use, and refusal skills. Two factor based subscales were used: *Condom use skills* (six items,  $\alpha = 0.85$ ) and *Refusal skills* (four items,  $\alpha = 0.72$ ).

### Risk-reduction social norms

Adolescents' perceptions of their partners' HIV-related normative perceptions were measured with the *Condom use social norms scale* (4 items,  $\alpha = 0.73$ ).

## Intervention procedures

Following baseline data collection, the three developments that composed each triad were randomly assigned to the community-level intervention, workshop intervention, or the education-only control condition (Fig. 1). Thus, five housing development communities received each intervention.

### Control intervention

All participants were invited to a standard community AIDS education session in the housing development. Recruitment procedures involved written announcements, phone contact, and door-to-door efforts. The session centered on viewing and discussing the videotape 'Time-Out' [25]. Condoms and educational brochures were made available in this and all conditions. On average, 15% (range 10–20%) of the adolescents attended this session. Upon study completion, control intervention adolescents were invited for ethical reasons to participate in the workshop intervention that followed the procedures described next.

### Workshop intervention

Two 3-h workshops (1 week apart), led by two trained facilitators, were held in each workshop development. Separate workshops were conducted for males and females divided by ages 12–14 and 15–17 years. Content included HIV/STD education, skills training to avoid and resist unwanted sexual activity, sexual negotiation skills, condom use skills, and risk behavior self-management,

	Control intervention condition	Workshop intervention condition	Community intervention condition
HIV educational session: video and discussion			
Educational brochures and free condoms			
Two, 3-h skills training workshops			
Two follow up sessions			
THPLC community activities and events			

**Fig. 1. Diagram of intervention components for study conditions.** THPLC, Teen Health Project Leadership Council.

integrated with themes of personal pride and self-respect. The workshops were based on interventions with documented efficacy [3,4,7] and focused on three aspects of risk avoidance: (1) delaying onset of sexual activity; (2) refraining from unwanted sex among those sexually active; and (3) consistently using condoms if one was or became sexually active. Adolescents received US\$ 20 for each session. Of the adolescents enrolled in the workshop condition, 87.2% (range = 83–92%) attended the workshops; of those, 89% attended both sessions.

### Community-level intervention

Adolescents in this condition first attended skills training workshops identical to those in the workshop condition; an average of 86.2% (range = 84–89%) of community-level condition adolescents attended. Workshops were followed by a multi-component community intervention: (1) follow-up sessions; (2) participation of opinion leaders in a Teen Health Project Leadership Council (THPLC); (3) THPLC-sponsored activities to create social and environmental supports for HIV risk avoidance; and, (4) HIV/AIDS workshops for parents.

### Follow-up sessions

Adolescents were invited to attend two follow-up sessions with peers from their social networks in the development. One was offered prior to implementation of the THPLC to bridge the workshops and community activities, and the second involved the opinion leaders and was carried out with THPLC support; 82.4% attended follow-up sessions (range 70–92%).

*Selection of opinion leaders and the THPLC*

Opinion leaders in each community development were identified by asking adolescents to nominate up to three peers from their workshop group who were liked and trusted. Facilitators also nominated three teens from each workshop group based on their leadership, communication, HIV knowledge and motivational skills. Opinion leaders, selected based on a combination of these nominations, were representative of adolescent participants in terms of gender, age, and ethnicity. The THPLC cadre represented 15% of the total number of adolescents in each development.

*THPLC activities and events*

Goals of the THPLC were to: (1) encourage follow-up session attendance; (2) use small media to reinforce abstinence and condom use; (3) plan HIV prevention activities to maintain risk reduction; (4) set norms supporting abstinence and condom use; and (5) gain support from adults to promote and reinforce THPLC activities.

Each THPLC met weekly with research staff to plan activities; US\$ 15 was received for each meeting attended. THPLCs were active for a 6-month period, developing and implementing four program activities for enrolled adolescents and two community-wide events. Initial activities involved the development of small media, including project themes emphasizing HIV prevention messages, such as: 'Don't hesitate to wait' and 'Say it loud, I'm safe and I'm proud'. Prevention themes were identified and used, for example, in project newsletters and tee-shirts. Adolescents were encouraged to make commitments to HIV risk reduction through pledges or videotaped testimonials. The small media and HIV prevention messages were showcased in community-wide activities that included social events, talent shows, musical performances and festivals. They were designed to establish and maintain HIV risk-reduction norms among friends, family members, and the community at-large.

*HIV-AIDS education workshops for parents*

Parents of enrolled adolescents were offered a 90-min workshop focused on HIV/AIDS information and strategies on how to discuss issues related to abstinence and condom use to empower parents to talk with their children about HIV/AIDS.

**Follow-up assessments of risk behavior**

Short-term follow-up assessments were administered 3 months following completion of the educational sessions in the control condition and the skills training workshops in the workshop and community-level conditions. Long-term follow-up assessments occurred 2 months following completion of the community intervention events in the community-level condition (approximately 12 months after workshops and 18 months after baseline for all

participants). Assessment procedures and incentives used in both follow-ups were identical to those used at baseline.

**Statistical methods**

Housing development was the unit of random assignment and analysis. Immediate impact of the workshop component of the intervention was evaluated with data from adolescents assessed at baseline and short-term follow-up; long-term impact of the two treatments was evaluated with data from adolescents assessed at baseline and long-term follow-up. A mixed-model approach (SAS 9.0 mixed-model macro GLIMMIX; SAS Inc., Cary, North Carolina, USA) was used for the binary endpoints with regression adjustment of covariates utilized to account for group-randomization and the interdependence of data from members within these groups [26].

**Results****Study cohort**

A total of 1172 adolescents completed surveys at baseline, representing 85% of all adolescents living in the developments. The sample was composed equally of male ( $n = 587$ ) and female ( $n = 585$ ) adolescents who averaged 14.5 years of age ( $SD = 1.7$ ), and were primarily of ethnic minority backgrounds (51% African American, 20% Asian, 10% East African, 5% White, 3% Hispanic, 3% Ukrainian, 2% Russian, 1% Native American and 5% other). There were no differences between the three conditions at baseline on demographics or sexual behavior. At short-term follow-up, 865 (74%; range, 60–86%) adolescents were still living in the developments and completed the assessment, with 763 (65%; range, 43–86%) adolescents completing long-term follow-up (see Fig. 2).

Adolescents who reported never engaging in sexual intercourse at baseline ( $n = 841$ ; 73%) and who completed follow-up constituted the study cohort for evaluating intervention effects on continued abstinence outcomes. Of those, 644 (77%) returned for the short-term follow-up and 580 (69%) for the long-term follow-up. Of all adolescents completing the short-term follow-up, 276 (32%) were sexually active; 282 (37%) of those completing long-term follow-up were sexually active and constituted the study cohort used to analyze intervention effects on condom use.

In comparison with adolescents who did not complete a short-term follow-up, the study cohort was slightly younger (14.37 versus 14.89 years) and had lived in the developments longer. They were less likely to have had sexual intercourse (25 versus 34%), or used tobacco (12 versus 23%), alcohol (14 versus 23%), or illegal drugs (10 versus 17%), and to have had an STD (1 versus 6%). These

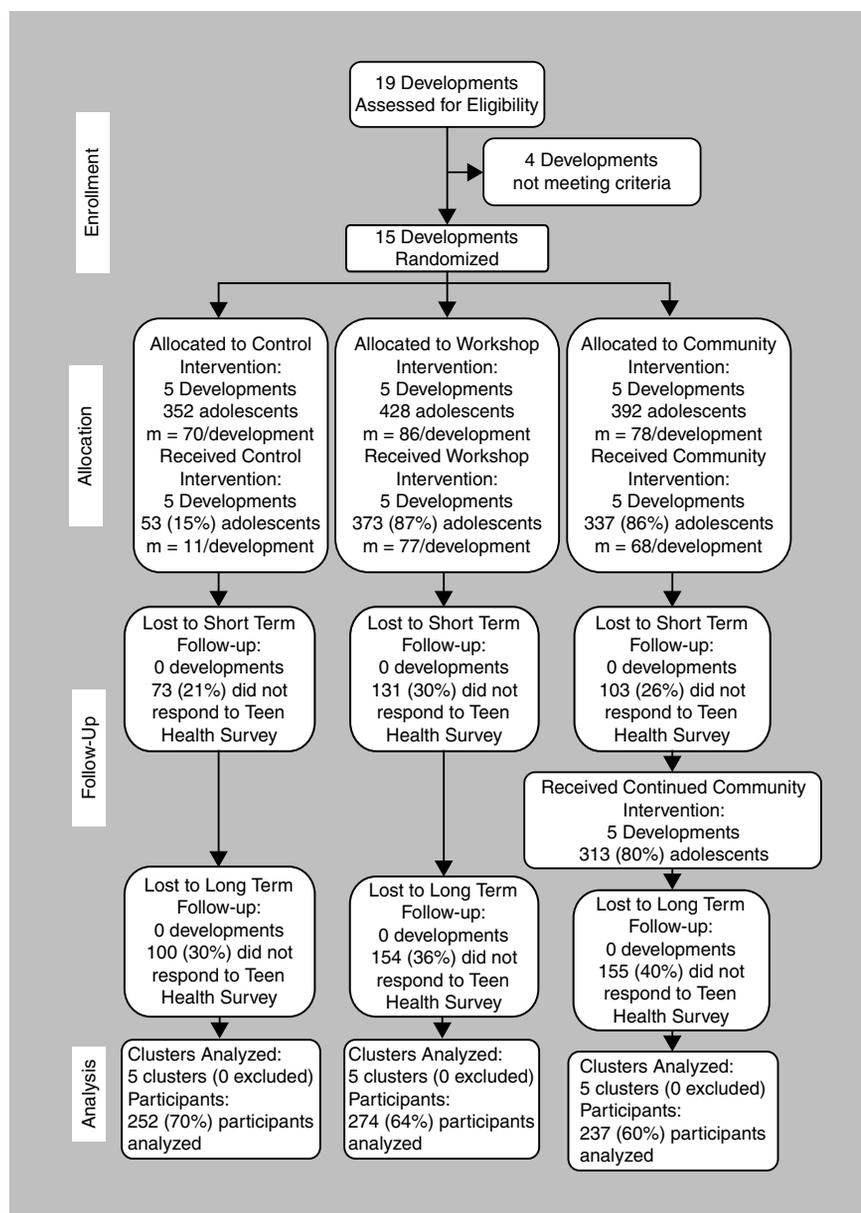


Fig. 2. Schematic diagram of participant flow in study design.

differences were also evident in the long-term follow-up cohort. Attrition did not differ across study conditions.

### Sexual activity and injection drug use among cohort adolescents at baseline

Of the 27% of adolescents in the study cohort who reported having sexual intercourse at baseline ( $n = 316$ ), 76% used a condom the last time they had intercourse. The average age at first intercourse was 12.5 years. In the year preceding the baseline, sexually active adolescents reported an average of almost four sexual partners, 11% ( $n = 37$ ) had anal intercourse in the previous 3 months, and 9% of the sexually active adolescents ( $n = 25$ ) said they had an STD in the past. Only 0.5% ( $n = 5$ ) of the

adolescents reported using injection drugs in the 3 months preceding the baseline.

### Effects of the intervention on continued abstinence

The continued abstinence rates at short- and long-term follow-up among adolescents who reported never engaging in sex at baseline are presented in Table 1. At short-term follow-up, the abstinence rate among adolescents in the control developments was equivalent to the rates of adolescents in the two intervention developments ( $t < 1.8$ ). At long-term follow-up, however, adolescents living in community intervention developments were more likely to have remained

**Table 1. Adjusted<sup>a</sup> mean percentage of adolescents continuing abstinence from baseline by treatment group and assessment point.**

	Clusters (n)	Adjusted <sup>b</sup> mean (SE)	Comparison	ICC	Adjusted odds ratio <sup>c</sup> 95% CI	T-value (P)
Short-term follow-up						
Control (C)	5 (194)	80.63 (3.98)	W - C	0.007	1.53 (4.21, 0.56)	0.93 (0.373)
Workshop (W)	5 (221)	85.90 (3.78)	W+ - C		1.67 (4.63, 0.60)	1.11 (0.292)
Community (W+)	5 (225)	86.71 (3.86)	W+ - W		1.09 (3.00, 0.40)	0.19 (0.854)
Long-term follow-up						
Control (C)	5 (177)	76.00 (2.93)	W - C	0.007	1.15 (2.03, 0.65)	0.53 (0.609)
Workshop (W)	5 (211)	78.36 (2.72)	W+ - C		1.97 (3.67, 1.06)	2.44 (0.035)
Community (W+)	5 (189)	85.42 (2.85)	W+ - W		1.72 (3.16, 0.94)	2.00 (0.074)

<sup>a</sup>Analyses adjusted for data clustering, age, gender, and baseline covariates (boyfriend/girlfriend, condom use social norms, risk-reduction self efficacy, condom use outcome expectations, risk-reduction intentions, risk-reduction behavioral skills).

<sup>b</sup>Proc Mixed estimated means and standard errors.

<sup>c</sup>Proc Glimmix analyses evaluated cluster mean differences and generated odds ratios, odd ratio 95% confidence intervals, and test statistics. ICC, intraclass correlation.

abstinent than adolescents living in the control developments ( $t_{(1,10)} = 2.22$ ,  $P < 0.05$ ; Table 1). The rate of continued abstinence among adolescents living in workshop developments was equivalent to that observed in the control developments. The difference in abstinence rates between the community and workshop developments approached significance ( $P = 0.07$ ).

At the long-term follow-up, continued sexual abstinence was more likely among females {odds ratio (OR), 1.92; 95% confidence interval (CI), 1.18, 3.10};  $t_{(1,10)} = 2.65$ ;  $P < 0.01$ }, more likely among adolescents not having a boyfriend or girlfriend in the year preceding the baseline [(OR, 5.31; 95% CI, 2.69, 10.49);  $t_{(1,10)} = 4.82$ ;  $P < 0.001$ ], and abstinence declined as age increased ( $b = -0.24$ ; SE = 0.07;  $f_{(1,551)} = 10.27$ ;  $P = 0.001$ ). Adolescents reporting higher risk-reduction intentions ( $b = 0.47$ ; SE = 0.24;  $f_{(1,551)} = 3.81$ ;  $P = 0.05$ ), lower condom use outcome expectations ( $b = -0.52$ ; SE = 0.19;  $f_{(1,551)} = 7.08$ ;  $P < 0.01$ ), and fewer risk-reduction behavioral skills at baseline ( $b = -2.06$ ; SE = 0.58;  $f_{(1,551)} = 12.89$ ;  $P < 0.0001$ ) were also more likely to continue abstinence at the long-term follow-up. There were no interactions between treatment and gender or treatment and partner status at baseline on continued abstinence at the long-term follow-up ( $\alpha = 0.05$ ).

### Effects of the intervention on condom use

Short term follow-up condom use rates (displayed in Table 2) among adolescents in the control developments were lower than those observed in the workshop developments ( $t_{(1,10)} = 3.04$ ;  $P = 0.01$ ). In addition to treatment, stronger baseline partner norms for condom use ( $b = 0.92$ ; SE = 0.28;  $f_{(1,261)} = 10.76$ ;  $P = 0.001$ ), and condom use self-efficacy ( $b = 0.19$ ; SE = 0.09;  $f_{(1,261)} = 3.90$ ;  $P = 0.05$ ) led to higher condom use rates in the short-term. Age, gender, and sexual activity status at baseline did not influence short-term follow-up condom use rates ( $\alpha = 0.10$ ).

At the long-term follow-up, condom use rates among control development adolescents were lower than rates observed in both the community and workshop condition developments (Table 2). In addition to treatment, higher baseline levels of abstinence self-efficacy ( $b = 0.18$ ; SE = 0.09;  $f_{(1,255)} = 4.61$ ;  $P < 0.05$ ), abstinence outcome expectations ( $b = 0.42$ ; SE = 0.18;  $f_{(1,255)} = 5.29$ ;  $P < 0.05$ ) and utilization of condom-related behavioral skills ( $b = 0.40$ ; SE = 0.10;  $f_{(1,255)} = 15.62$ ;  $P = 0.0001$ ) increased condom-use rates at the long-term follow-up. Finally, adolescents who were younger ( $b = -0.29$ ; SE = 0.11;  $f_{(1,255)} = 7.33$ ;  $P < 0.01$ ) and reported using fewer refusal skills at baseline ( $b = -0.36$ ; SE = 0.15;

**Table 2. Adjusted<sup>a</sup> mean percentage of adolescents using condoms at last intercourse by treatment group and assessment point.**

	Clusters (n)	Adjusted <sup>b</sup> mean (SE)	Comparison	ICC	Adjusted odds ratio <sup>c</sup> 95% CI	T-value (P)
Short-term follow-up						
Control (C)	5 (103)	67.00 (9.89)	W - C	0.003	3.96 (10.88, 1.44)	3.04 (0.013)
Workshop (W)	5 (87)	88.06 (10.08)	W+ - C		1.91 (4.70, 0.78)	1.6 (0.140)
Community (W+)	5 (88)	78.57 (10.14)	W+ - W		2.07 (1.36, 0.17)	1.57 (0.149)
Long-term follow-up						
Control (C)	5 (107)	61.89 (10.85)	W - C	0.001	2.23 (5.03, 0.99)	2.20 (0.053)
Workshop (W)	5 (99)	76.34 (10.61)	W+ - C		2.50 (6.22, 1.01)	2.24 (0.049)
Community (W+)	5 (76)	77.45 (12.26)	W+ - W		1.12 (2.82, 0.45)	0.28 (0.787)

<sup>a</sup>Analyses adjusted for data clustering, age, gender, and baseline covariates (boyfriend/girlfriend, condom use social norms, risk-reduction self efficacy, condom use outcome expectations, risk-reduction intentions, risk-reduction behavioral skills).

<sup>b</sup>Proc Mixed estimated means and standard errors.

<sup>c</sup>Proc Glimmix analyses evaluated cluster mean differences and generated odds ratios, odd ratio 95% confidence intervals, and test statistics. ICC, intraclass correlation.

$f_{(1,255)} = 5.77$ ;  $P < 0.05$ ) reported higher long-term follow-up rates of condom use.

## Discussion

Community-level HIV prevention interventions present the opportunity to reach large numbers of youth and to create a social context in which risk-reduction efforts can be supported and maintained. While numerous studies have demonstrated the efficacy of skills training interventions in reducing HIV risk behavior among adolescents, community-level trials have received far less attention. This multi-component, community intervention implemented with adolescents living in low-income housing developments shows considerable promise and produced substantial effects, both in relation to age of sexual debut over time and also in condom use for sexually active adolescents. These findings are relevant not only to HIV prevention, but also to adolescent health since early age of sexual debut has been related to other social and health problems such as unwanted teenage pregnancy, other STDs, and other problem behaviors [27,28].

Among sexually active adolescents in the sample, the skills training component presented in both treatment conditions increased use of condoms at last intercourse. At the short-term follow-up, condom use was higher among adolescents in the workshop developments in comparison with control condition adolescents. At the long-term follow-up, adolescents in both the workshop and community intervention developments used condoms more often than control condition adolescents. It appears that, as has been suggested by previous research [3–8,10], the skills training component was powerful enough to increase and maintain higher rates of condom use.

The effect of the community-level intervention was apparent in the continued abstinence rates of teens not sexually active at baseline. At the long-term follow-up, adolescents living in the community intervention developments were more likely to delay onset of first sexual intercourse than adolescents in control condition developments, with a similar trend when compared with adolescents in the workshop developments. No differences were found, however, in the onset of first sexual intercourse between adolescents in the control and workshop developments. Although female adolescents were more likely than males to continue abstinence, the community intervention effect for delaying onset of first intercourse did not differ by gender. Differences in abstinence rates did not emerge, however, until the long-term follow-up, suggesting that the ongoing community intervention was important for both initiating and maintaining risk avoidance.

The HIV prevention community intervention involved conducting neighborhood-based risk avoidance and risk-reduction skills training workshops followed by community activities to support and maintain adolescents' efforts toward behavior change. Important program components included the selection of influential peer leaders who developed and implemented community-wide intervention activities. In fact, the robustness of the findings may have been due to the combination of skills-building and community activities that supported adolescents' efforts toward abstinence and condom use, suggesting that HIV primary prevention interventions should incorporate social and environmental factors and be extended over time to initiate or maintain effects.

Limitations of the study include the statistical challenges involved by utilizing group randomization of developments within cities when small sample sizes result, as shown in examining the condom use outcomes. In addition, although the intervention was evaluated by assessing a large percentage of all adolescents living in each housing development community, the youth who were lost to follow-up had higher initial levels of sexual and substance use activity than those who remained in the study cohort (although attrition did not differ by study condition). This may limit the generalizability of the condom use findings among higher risk youth. Lastly, our findings cannot determine whether the effectiveness of the community-level intervention was due to specific components, the continued interaction with the adolescents, or the potential influence of small financial incentives.

Adolescents are increasingly at risk for HIV, and large-scale efforts are needed to reduce sexual risk behavior among youth. This study demonstrates the effectiveness of a community-level HIV prevention intervention in delaying onset of first intercourse and increasing condom use that would need to avert only a small number of HIV infections to be cost-saving to society [27]. Similar types of behavior change have been associated with decreases in HIV prevalence in international settings [28–30], including early age of first sex as predictive of prevalent HIV infection [31]. Community-level interventions are urgently needed to reduce risk for HIV/AIDS among vulnerable adolescents and young adults.

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