

# Community-Level HIV Intervention in 5 Cities: Final Outcome Data From the CDC AIDS Community Demonstration Projects

## ABSTRACT

**Objectives.** This study evaluated a theory-based community-level intervention to promote progress toward consistent condom and bleach use among selected populations at increased risk for HIV infection in 5 US cities.

**Methods.** Role-model stories were distributed, along with condoms and bleach, by community members who encouraged behavior change among injection drug users, their female sex partners, sex workers, non-gay-identified men who have sex with men, high-risk youth, and residents in areas with high sexually transmitted disease rates. Over a 3-year period, cross-sectional interviews ( $n = 15\ 205$ ) were conducted in 10 intervention and comparison community pairs. Outcomes were measured on a stage-of-change scale. Observed condom carrying and intervention exposure were also measured.

**Results.** At the community level, movement toward consistent condom use with main ( $P < .05$ ) and nonmain ( $P < .05$ ) partners, as well as increased condom carrying ( $P < .0001$ ), was greater in intervention than in comparison communities. At the individual level, respondents recently exposed to the intervention were more likely to carry condoms and to have higher stage-of-change scores for condom and bleach use.

**Conclusions.** The intervention led to significant communitywide progress toward consistent HIV risk reduction. (*Am J Public Health.* 1999;89:336-345)

*The CDC AIDS Community Demonstration Projects Research Group*

Community-level interventions represent a promising approach to prevention of HIV infection. They aim to change communitywide norms and practices in order to support individuals' efforts to change.<sup>1,2</sup> Since the 1970s, community-level interventions have addressed various health issues, including smoking cessation<sup>3-5</sup> and the control and prevention of coronary heart disease.<sup>1,6-10</sup> However, "the size of effects has been meager in relation to the effort expended."<sup>11</sup> In many studies, positive behavioral changes were seen in both the treatment and comparison areas, a result that seemed to be due in part to unexpectedly steep trends toward reducing unhealthy behaviors.<sup>4,11-13</sup>

Nevertheless, community-level interventions have had some success in prevention of HIV infection. Kelly and colleagues trained gay men to talk about prevention with their peers and to endorse behavior changes.<sup>14</sup> After the intervention, unprotected sexual intercourse decreased and condom use for anal intercourse increased. These trends continued for 3 years after the intervention,<sup>15</sup> and similar results were achieved when Kelly et al. replicated this study in 8 cities.<sup>16</sup> A community-level approach has also been used to reach young men who have sex with men.<sup>17</sup> Street outreach programs, mass media campaigns, and other forms of community-level interventions have been used extensively to reach injection drug users and other at-risk populations.<sup>2,18-20</sup>

Few studies have analyzed the degree to which community-level programs have led to behavioral changes at the community level. Rather, most have addressed changes among individuals. Here we describe the outcome evaluation results from the AIDS Community Demonstration Projects, an innovative 5-city trial to evaluate the effects of a community-level intervention for underserved populations at risk for HIV infection.<sup>21-23</sup>

## Methods

The AIDS Community Demonstration Projects were conducted in Dallas, Tex; Denver, Colo; Long Beach, Calif; New York City; and Seattle, Wash. In each city, the project focused on members of 1 to 3 of the populations at increased risk for HIV infection: active injection drug users, female sex partners of male injection drug users, female commercial sex workers and other women who trade sex for money or drugs, youth in high-risk situations, non-gay-identified men who have sex with men, and residents of census tracts where rates of sexually transmitted diseases are high. A community was defined as an at-risk population in a specific geographic region. A total of 10 intervention-comparison community pairs were studied (Table 1).

The study design, data collection methods, and intervention activities have been described in detail elsewhere.<sup>21-24</sup> These activities were approved by human subjects review boards at each of the study sites.

## Intervention Activities

All sites used a common intervention protocol that was based on behavioral theo-

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ries,<sup>23-25</sup> ethnographic research in the study communities,<sup>26</sup> and intervention strategies used in community-level trials.<sup>5,10,27</sup> The intervention had 3 key components: (1) mobilization of community members to distribute and verbally reinforce prevention messages and materials among their peers, (2) creation of small-media materials featuring theory-based prevention messages in the form of role-model stories, and (3) increased availability of condoms and bleach kits.

Persons from the targeted at-risk communities, other local residents, and persons from area businesses who had regular contact with the target population were recruited and trained to distribute the intervention materials in their community. These persons focused the recipients' attention on the HIV infection prevention messages in these materials and reinforced the recipients' attempts to adopt and maintain risk reduction practices.<sup>28-31</sup> From July 1991 to June 1994, nearly 1000 people were recruited and trained to distribute materials.

The small-media materials (e.g., community newsletters, pamphlets, baseball cards) contained authentic stories about people from the community that described how they were changing (or preparing to change) their HIV-related risk behaviors. The materials also contained basic AIDS information, instructions on the use of condoms, and other community-related information.<sup>32,33</sup> A total of 585 000 small-media materials were distributed across all sites.

Each story described the role model's progress toward the consistent practice of 1 of 5 risk reduction behaviors: condom use for (1) vaginal or (2) anal sex with a main partner (steady partner or spouse); condom use for (3) vaginal or (4) anal sex with non-main partners (casual partners, one-time partners, paying partners); or (5) use of bleach to clean needles, syringes, and other equipment used to prepare or inject drugs. Because data on condom use during anal sex with nonmain partners were collected for only 1 population, we do not address condom use during anal sex in this report.

The messages, as well as the overall intervention strategy, were based on behavior change theory.<sup>34-39</sup> The role-model stories emphasized factors that behavioral theory associates with the adoption of reduced-risk practices (such as attitudes, perceived norms, and self-efficacy) and that were empirically associated with risk behavior in periodic analyses of data collected in each of the 10 intervention communities.<sup>22,24,32</sup>

The stories emphasized specific stages on a continuum of behavior change as specified by the transtheoretical model of behavior change. The primary goal of the intervention

**TABLE 1—Demographic and Risk Characteristics of the Intervention Group, the Comparison Group, and the Total Sample: CDC AIDS Community Demonstration Projects, 1991–1994**

	Intervention Group (n = 8015), %	Comparison Group (n = 7190), %	Total Sample (n = 15205), %
<b>Community pair</b>			
Dallas—high STD pair 1	12.5	15.7	14.0
Dallas—high STD pair 2	7.7	10.0	8.8
Denver—IDU	12.3	8.8	10.6
Long Beach—CSW	13.6	16.6	15.0
Long Beach—FSP	5.1	5.5	5.3
Long Beach—IDU	14.4	8.6	11.7
New York—FSP	9.8	11.3	10.5
Seattle—CSW	9.5	7.5	8.5
Seattle—MSM	5.7	6.6	6.1
Seattle—youth	9.5	9.5	9.5
<b>Sex</b>			
Female	52.8	56.3	54.5
Male	47.2	43.7	45.5
<b>Race/ethnicity**</b>			
African American	55.6	52.9	54.3
White	22.3	21.8	22.0
Hispanic	16.8	20.6	18.6
Other	5.3	4.8	5.0
<b>Age**</b>			
11–29 y	33.1	38.0	35.4
30–39 y	40.4	39.0	39.7
40–87 y	26.5	23.0	24.9
<b>Lifetime HIV risk</b>			
Injection drug use**	57.5	47.7	52.9
Sex for money/drugs (women only)*	60.3	55.1	57.8
Same-sex contact (men only)**	21.4	20.8	21.1

Note. High STD = residents of census tracts having high rates of sexually transmitted diseases; CSW = commercial sex workers; FSP = female sex partners; IDUs = injection drug users; MSM = non-gay-identified men who have sex with men.

\* $P < .05$  (Cochran-Mantel-Haenszel  $\chi^2$  stratified by community pair).

\*\* $P < .001$  (Cochran-Mantel-Haenszel  $\chi^2$  stratified by community pair).

was to move people from precontemplation (no intention to adopt a given behavior) to contemplation (short-term or long-term intention to adopt the behavior) to preparation (short-term intention to adopt the behavior and some attempts to adopt the behavior) to action (adoption and consistent practice of the behavior for less than 6 months) and, finally, to maintenance (adoption and consistent practice of the behavior for 6 months or longer).<sup>23,40-42</sup>

The importance of environmental facilitation led to an early decision to distribute condoms and bleach kits along with the small-media materials.<sup>22,24</sup> Each site tailored the intervention to meet local needs. Details of the specific interventions in the participating cities are presented elsewhere.<sup>22,30,31,43</sup>

#### Study Design and Data Collection

The effects of the projects were evaluated by means of a nested cross-sectional design<sup>9</sup> with repeated sampling over time in matched intervention and comparison communities. The design was considered quasi-

experimental because communities were randomly assigned (by coin toss) to treatment condition only in Dallas. In the other community pairs, assignment to intervention status was limited by resources such as office space for intervention activities. On the basis of formative research at each site, community pairs were matched by accessibility and density of at-risk target community members (e.g., observable sale and use of illicit drugs, presence of commercial sex workers), basic demographic characteristics (e.g., race/ethnicity, socioeconomic status), and the physical characteristics of interview locations (e.g., number and type of businesses, presence of residential housing).

In 2 instances, comparable intervention and comparison community pairs could not be found in a nearby community. For Seattle non-gay-identified men who have sex with men, a suitable comparison community was found in Long Beach. In Denver, extensive movement of injection drug users between the intervention and comparison communities was detected after data collection began.<sup>44</sup> Therefore, data collection at the

Denver comparison site was suspended and responses from the Long Beach comparison community of injection drug users were systematically divided into 2 groups to form a new Denver comparison group and a separate Long Beach comparison group.

To evaluate the effect of the intervention, anonymous field interviews were conducted in 10 cross-sectional waves from February 1991 through June 1994. The first 2 waves were completed before the implementation of intervention activities, and the remainder over the 32-month intervention period. Interviewers could not be blinded to the assignment of communities because project materials were observable in the intervention communities.

Sampling quotas were established for the specific risk behaviors targeted for intervention in each community (e.g., female sex partners of injection drug users who practiced vaginal intercourse with their main partners). In most communities, random number tables were used to select potential respondents. For Long Beach and for Seattle non-gay-identified men who have sex with men, the times and locations for interviews were randomized, and staff attempted to approach all potential respondents in an interview location. These methods are similar to those commonly used to recruit respondents in hard-to-reach communities.<sup>45</sup>

Potential respondents were approached on the street (non-gay-identified men who have sex with men were approached in adult bookstores or other public sex-related environments) and asked to complete a brief screening interview. The screening interview (typically lasting less than 5 minutes) provided basic data on demographics, membership in a targeted at-risk community, and HIV risk. Persons who met study eligibility criteria were asked to complete the standard interview (lasting, on average, an additional 10 minutes). Eligibility criteria for the standard interview were (1) membership in one of the at-risk communities targeted by the local site and (2) vaginal or anal intercourse in the 30 days before interview or sharing needles for drug injection in the 60 days before interview. Respondents were given small payments of cash or food coupons for participating.

*Measures*

The standard interview yielded basic information about HIV risk-related behaviors and behavioral determinants. For the behaviors of condom use with main and non-main partners and bleach use, we used the Stages of Change continuum as our outcome measure. An increase in the mean stage-of-

change score indicated progress toward the behavioral goal. The development and computation of the Stage of Change scale and the other measures have been described in detail elsewhere.<sup>22,43,46</sup>

*Exposure to intervention.* At the end of the interview, respondents were asked to describe anything they had seen or heard in the past 3 months "around here in the community" about how to protect themselves from HIV infection. Interviewers asked the source of this information to determine whether the information was associated with the AIDS Community Demonstration Projects intervention. Respondents who reported that they had talked with a project volunteer or staff person or had received project intervention materials were coded as having been exposed to the intervention.

*Stage of change for condom use.* For a given behavior, stage of change was defined by a 5-point ordinal scale ranging from precontemplation to maintenance. The scale for condom use was as follows:

- 1 = Precontemplation: has little or no intention to always use condoms in the future
- 2 = Contemplation: does not use condoms but intends to begin using them every time in the future
- 3 = Preparation: almost always or sometimes uses condoms *and* intends to use condoms every time in the future
- 4 = Action: has used condoms every time for less than 6 months
- 5 = Maintenance: has used condoms every time for 6 or more months

Responses to items regarding condom use frequency, history of condom use, and intention to use condoms consistently in the future were used to develop a stage-of-change score for each respondent who reported having vaginal sex in the past 30 days with a main or nonmain partner, according to an algorithm that was empirically derived for this study.<sup>46</sup>

*Stage of change for bleach use.* The stage of change for bleach use was computed by using the same approach as for condom use. Injection drug users were staged on bleach use only if they reported having shared needles in the past 60 days. Thus, injection drug users who had not shared injection equipment were excluded from analyses on stage of change for bleach use.

*Condom carrying.* All respondents were asked during the interview whether they were carrying a condom. All who answered yes were asked to show the condom to the interviewer. Respondents who produced a condom were coded as carrying condoms. Respondents who did not show a condom to

the interviewer were coded as not carrying condoms.

*Survey Respondents*

As shown in Table 1, the sample was based on data from 15 205 interviews. A total of 51 235 screening interviews were conducted from February 1991 to June 1994 in the 10 matched community pairs. Of these, 16 311 longer interviews were initiated with persons who were eligible to participate, 16 134 (98.9%) of whom completed this interview. According to demographic information, 929 responses appeared to be repeats (i.e., a person interviewed more than once in a single wave); a coin was tossed to determine which of the completed interviews to retain for data analysis. Repeat standard interviews across different waves were not excluded. Thus, a person could be sampled in more than one wave but only once within one wave. The proportion of respondents who had been interviewed more than once did not differ significantly between the intervention and comparison communities.

*Community-Level Analyses*

Because the unit of treatment assignment for the AIDS Community Demonstration Projects was communities, we adapted the methods of Murray and colleagues<sup>9,47</sup> to generate community-level data based on individual observations from the interviews. We conducted a random-coefficients analysis, using a 2-stage hierarchical regression procedure to measure the effects of the intervention on each outcome variable at the community level. In the first stage, linear models were used to generate least squares adjusted means for each of the 10 intervention-comparison pairs for each data collection wave. These adjusted means were controlled for sex, race/ethnicity, age, and lifetime history of injection drug use, man-to-man sex, and, among women, trading sex for money or drugs. In the second step of the hierarchical regression process, the adjusted means for each community provided the observations for a mixed regression model to measure changes over time for each outcome variable of interest.

Because stage of change is ordinal rather than continuous, we originally developed a method using parameters from logistic models to generate "covariate-adjusted measures of central tendency" as the first step of the process described above. However, we subsequently observed that these values were almost indistinguishable from those based on linear parameters; therefore, we chose to employ the more familiar least

squares means for both the ordinal and dichotomous outcome variables. All analyses were replicated with unadjusted raw means; the results were the same as those from the analyses with adjusted means (i.e., the significant results remained significant), which took into account variations in the composition of the study sample between the treatment conditions and over time.

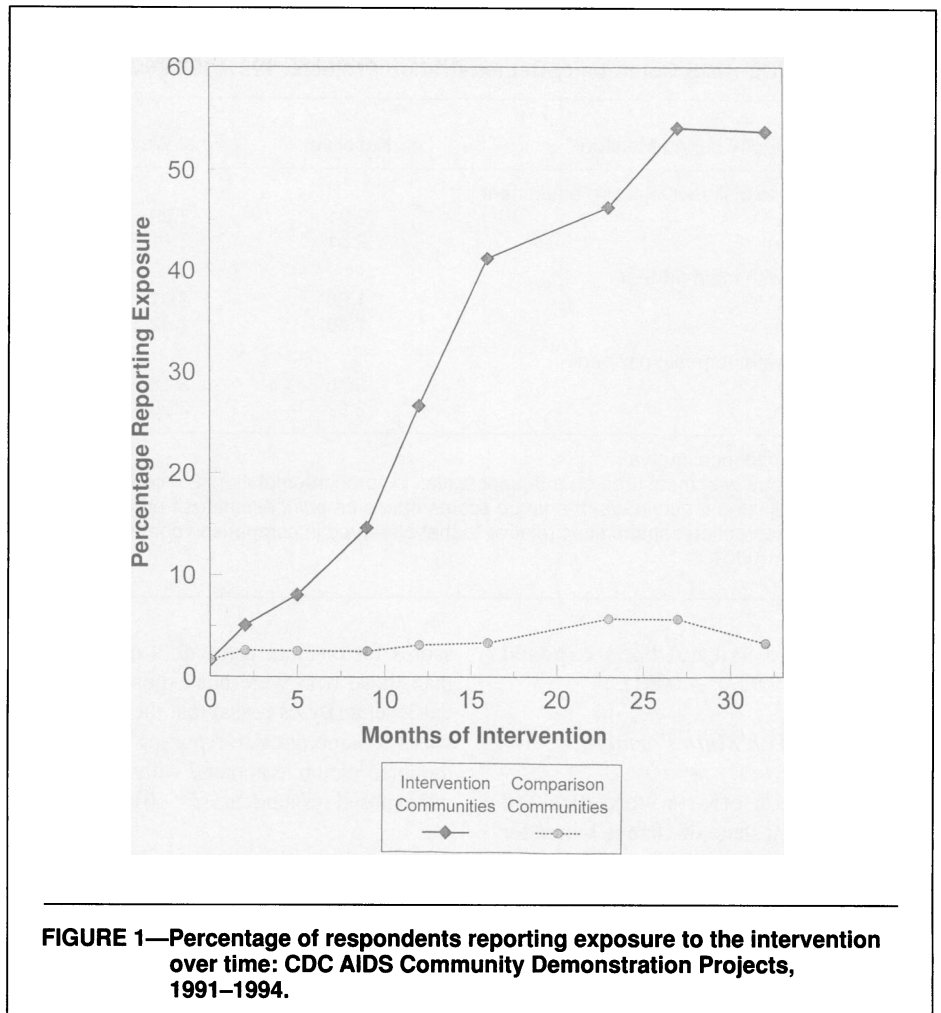
Independent variables for the mixed models were treatment (intervention or comparison) and time, which was analyzed as a continuous variable. Each data collection wave was represented in the model as the number of months elapsed since the intervention was initiated, divided by 32 (the midpoint of the final data collection wave). Thus, the 2 waves collected at baseline were coded as time 0 and the final wave was coded as time 1. Quadratic and cubed terms for time were included as appropriate. Community pair and appropriate interaction terms were included as random effects in the mixed models.

To evaluate the differential effect of the intervention across time, we added a treatment  $\times$  time interaction term to each model. This term measures the extent to which changes from baseline to the end of the study in the intervention communities exceeded changes in the comparison communities.

A priori (planned) comparisons were conducted to aid in the interpretation of findings from the outcome analyses in which mean stage-of-change score was the outcome. These comparisons assessed the extent to which changes in mean scores were associated with movement between stages. Four dichotomous variables were computed to represent the communities' movement into successively higher stages of change. For example, the first dichotomous variable contrasted persons in the 4 higher stages with those in the precontemplation stage. Tests for changes over time in the intervention and comparison communities were evaluated separately for each of the dichotomous variables by means of the 2-stage approach already described.

#### Individual-Level Analyses

Since exposure to the intervention took place on the individual level, not the community level, analyses were conducted to determine the extent to which exposure to the intervention was associated with outcomes in the intervention communities. The effect of intervention exposure was tested by linear or logistic models in which a single independent variable represented recent exposure (exposed vs unexposed in past 3 months). The model was adjusted for data collection wave as well as for the demo-



**FIGURE 1—Percentage of respondents reporting exposure to the intervention over time: CDC AIDS Community Demonstration Projects, 1991–1994.**

graphic and risk history covariates already described.

The relationships between demographic variables and risk behaviors are elaborated on in other published articles.<sup>24,44,48–51</sup>

## Results

### Exposure to the Intervention

Recent exposure to the intervention increased in the intervention communities from 5% during month 2 to a peak of 54% during month 27 (Figure 1). Thus, by the end of the intervention, more than half of the target population had been reached at least once in the prior 3 months. A small amount of cross-contamination was observed: 3% to 6% of persons in comparison communities reported recent exposure to the intervention.

### Use of Bleach to Clean Injection Equipment

Complete stage-of-change data for bleach use were obtained only from the fol-

lowing community pairs: commercial sex workers in Long Beach and injection drug users in Dallas, Denver, and Long Beach. A total of 3551 individual responses were used to compute the community-level means. At baseline, mean stage-of-change scores for bleach use indicated that most respondents in both conditions were in the preparation stage or a later stage. Over time, the mean scores did not change significantly in either condition; scores increased by 0.08 in the intervention communities but decreased by 0.10 in the comparison communities (Table 2). Examination of the dichotomous scores representing transitions into higher stages revealed no significant differential changes over time (Table 3). The only significant changes occurred in the comparison communities, reflecting a relapse from consistent bleach use (represented by the action and maintenance stages).

Examination of the effects of exposure to the intervention on individual-level data in the intervention communities revealed a significant association between exposure and stage-of-change scores for bleach use. Across all waves, respondents who had been exposed to the intervention had higher scores

**TABLE 2—Change in Adjusted Mean Stage-of-Change Scores for Intervention and Comparison Communities Over Time: CDC AIDS Community Demonstration Projects, 1991–1994**

Stage-of-Change Measure <sup>a</sup>	Baseline	Final Wave	Absolute Change <sup>b</sup> (95% CI)	Differential Change <sup>c</sup> (95% CI)
Use of bleach to disinfect injection equipment				
Intervention	2.91	2.99	0.08 (−0.12, 0.28)	0.19 (−0.10, 0.47)
Comparison	2.51	2.41	−0.10 (−0.3, 0.10)	
Condom use with main partner				
Intervention	1.66	2.07	0.41 (0.26, 0.56)**	0.19 (0.01, 0.38)*
Comparison	1.60	1.82	0.21 (0.07, 0.36)*	
Condom use with nonmain partners				
Intervention	2.76	3.18	0.42 (0.20, 0.64)**	0.34 (0.04, 0.63)*
Comparison	2.82	2.90	0.08 (−0.14, 0.30)	

Note. CI = Confidence interval.

<sup>a</sup>Stage of change was measured on a 5-point scale: 1 = precontemplation; 2 = contemplation; 3 = preparation; 4 = action; 5 = maintenance.

<sup>b</sup>Change in adjusted mean stage-of-change scores based on point estimates from all 10 waves of data.

<sup>c</sup>Change in intervention communities relative to that observed in comparison communities.

\* $P < .05$ ; \*\* $P < .0001$ .

than those who had not been exposed (mean = 3.25 vs 2.93,  $P < .0001$ ).

#### Condom Use With Main Partner

Intervention efforts were directed toward increasing stage-of-change scores for condom use during vaginal sex with a main partner in all 10 communities. Across all waves of data collection, 9457 individual responses were obtained on this measure. At baseline, scores indicated that most respondents in both the intervention and comparison communities were in the precontemplation stage (Table 2). By the final wave of data collection, scores had increased significantly in both conditions (Figure 2). As shown in Table 2, the increase in the intervention communities was significantly greater than the increase in the comparison communities—an absolute increase of 0.41 vs 0.21.

Comparisons of the dichotomous community-level scores revealed significant increases in stage of change for condom use with a main partner for the intervention communities across each of the 4 transitions (Table 3). The largest increase was in the first transition, representing movement from precontemplation into subsequent stages. This indicates that although the intervention was associated with positive movement across all stages of change, the only significant differential change was associated with movement out of the precontemplation stage. Changes observed in the comparison communities were also significant for 3 of the 4 transitions.

As was true of bleach use, respondents in the intervention communities who reported recent exposure to the intervention had, on average, higher stage-of-change

scores for condom use with a main partner than those who were not exposed. Individual-level analyses reveal that the mean score was 1.97 among those reporting exposure to the intervention, compared with 1.83 among nonexposed respondents ( $P < .01$ ).

#### Condom Use with Nonmain Partners

The intervention addressed condom use with nonmain partners in all of the intervention communities except for the 2 female-sex-partner community pairs. Across intervention waves, 7760 responses were obtained on stage of change for condom use during vaginal sex with nonmain partners. Mean scores show that most respondents were in the preparation stage or an earlier stage at baseline (Table 2). Over time, the mean stage-of-change score increased significantly in the intervention communities relative to the comparison communities (Figure 2). The increase in the intervention communities was 5 times that in the comparison communities.

For nonmain partners, as for main partners, comparisons of the dichotomous community-level scores revealed significant increases in the intervention communities across each of the 4 transitions (Table 3). The largest differential increases were for the later 2 transitions, representing movement from earlier stages during which condoms were not used (or were used inconsistently) to later stages in which respondents either had started using condoms consistently or had maintained consistent condom use for 6 months or longer. Significant differences were not observed in the comparison communities.

Recent exposure to the intervention was significantly associated with higher stage-of-change scores. Among intervention commu-

nity respondents, those reporting recent exposure to the intervention had higher mean scores across data collection waves than nonexposed respondents (mean = 3.33 vs 3.01,  $P < .0001$ ).

#### Observed Condom Carrying

Community-level data for condom carrying were obtained for all 10 community pairs; these data are based on 13 958 respondents who reported having had vaginal or anal intercourse in the past 30 days. The mean proportion of respondents carrying condoms in the intervention communities increased significantly over time (Figure 3). Relative to the baseline value of 17.4%, observed condom carrying increased by 73.6% in the intervention communities, to 30.2% by the end of the intervention (absolute increase = 12.8%, 95% confidence interval [CI] = 8.0%, 17.6%). Condom carrying increased only slightly in the comparison communities (from 18.5% at baseline to 18.9% at the end of the study; absolute increase = 0.4%, 95% CI = −4.4%, +5.2%). A differential increase of 12.4% occurred in the intervention communities (95% CI = 6.8%, 18.0%;  $P < .0001$ ).

At the individual level, recent exposure to the intervention was strongly associated with observed condom carrying. Across the intervention period, 31.3% of exposed respondents were carrying a condom, compared with 19.8% of nonexposed respondents in the intervention communities ( $P < .0001$ ).

#### Discussion

These findings indicate that the AIDS Community Demonstration Projects inter-

**TABLE 3—Change in Percentage of Intervention and Comparison Community Respondents at Specific Stages in the Stage-of-Change Continuum Over Time: CDC AIDS Community Demonstration Projects, 1991–1994**

Stage of Change	Baseline, %	Final Wave, %	Absolute Change, % (95% CI)	Differential Change, % (95% CI)
<b>Bleach use to disinfect injection equipment</b>				
Contemplation or higher				
Intervention	79.5	83.0	3.5 (–5.1, 12.2)	3.8 (–8.9, 16.6)
Comparison	69.8	69.5	–0.3 (–8.9, 8.4)	
Preparation or higher				
Intervention	65.1	72.1	6.9 (–0.6, 14.5)	–1.3 (–12.3, 9.7)
Comparison	51.7	59.9	8.2 (0.7, 15.8)*	
Action or higher				
Intervention	26.6	22.9	–3.7 (–10.7, 3.3)	6.5 (–3.5, 16.6)
Comparison	16.1	5.9	–10.2 (–17.2, –3.2)**	
Maintenance				
Intervention	19.8	21.2	1.4 (–6.0, 8.8)	9.5 (–1.0, 20.0)
Comparison	13.4	5.3	–8.1 (–15.5, –0.7)*	
<b>Condom use with main partner</b>				
Contemplation or higher				
Intervention	30.1	44.0	13.9 (8.5, 19.4)**	7.5 (1.1, 14.0)*
Comparison	26.8	33.2	6.4 (0.9, 11.8)*	
Preparation or higher				
Intervention	20.4	33.4	12.9 (8.3, 17.6)***	5.2 (–0.6, 11.1)
Comparison	17.7	25.4	7.7 (3.1, 12.3)**	
Action or higher				
Intervention	8.5	17.0	8.5 (4.7, 12.3)***	4.2 (–0.7, 9.1)
Comparison	9.1	13.4	4.3 (0.5, 8.1)*	
Maintenance				
Intervention	7.0	12.5	5.5 (2.1, 8.9)**	2.9 (–1.9, 7.6)
Comparison	7.2	9.8	2.6 (–0.8, 6.0)	
<b>Condom use with nonmain partners</b>				
Contemplation or higher				
Intervention	70.9	81.1	10.3 (4.2, 16.3)**	7.0 (–1.5, 15.5)
Comparison	70.2	73.5	3.3 (–2.8, 9.4)	
Preparation or higher				
Intervention	58.6	73.1	14.5 (7.6, 21.5)***	7.8 (–2.2, 17.8)
Comparison	58.4	65.1	6.8 (–0.2, 13.7)	
Action or higher				
Intervention	24.6	33.4	8.7 (2.2, 15.3)**	9.2 (0.7, 17.7)*
Comparison	27.4	27.0	–0.5 (–7.0, 6.1)	
Maintenance				
Intervention	21.7	30.2	8.5 (2.1, 14.9)**	9.4 (1.2, 17.7)*
Comparison	25.6	24.7	–0.9 (–7.3, 5.5)	

Note. CI = Confidence interval.

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .0001$ .

vention reached the target population and motivated them toward adopting HIV risk-reduction behaviors. The significant increases in condom carrying and stage-of-change scores for condom use were observed not only among individuals reached directly by the intervention but across the study communities as a whole. The ability of the intervention to reach and motivate change in these geographically and demographically diverse communities suggests the potential usefulness of this approach to HIV prevention.

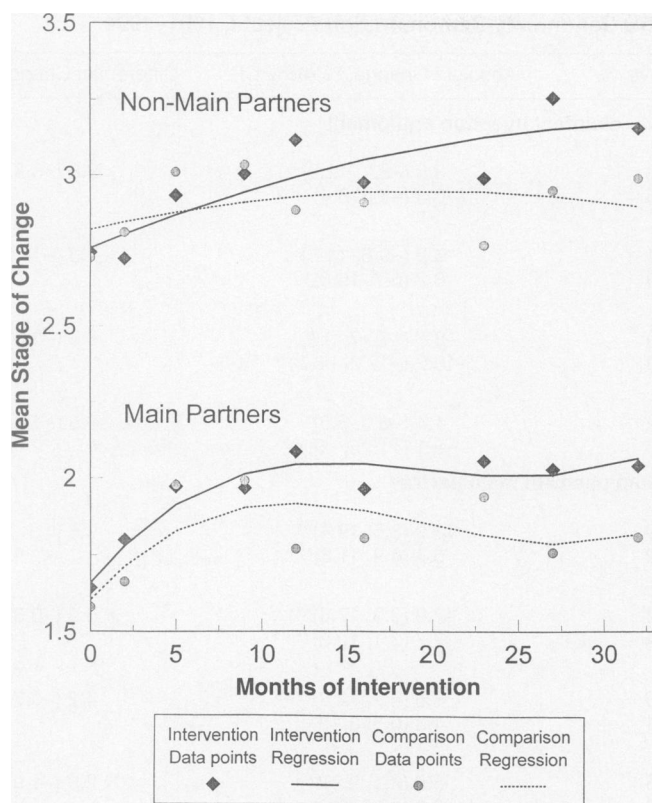
The participation of community members in delivering the intervention made it possible to reach many more persons than could have been reached by paid staff alone. Near the end of the intervention, slightly

more than half of the persons interviewed in the intervention communities reported having been exposed to project prevention materials or volunteers in the past 3 months. This high level of community exposure may be attributed in part to the large number and type of community volunteers who disseminated prevention materials and role-model stories to their peers.<sup>22,28,30</sup> These volunteers reached community members who might otherwise not have participated in facility-based prevention programs. Furthermore, their presence may have served as a steady reminder of the risk reduction messages disseminated by the AIDS Community Demonstration Projects and provided ongoing reinforcement of behavior change efforts.

Because the intervention had multiple components, however, we cannot attribute outcomes to any one component. It is possible, for example, that condom distribution alone would have led to a significant increase in stage-of-change scores.

The intervention was most successful in promoting movement toward consistent condom use for vaginal sex with main and nonmain partners. This is reflected in significant changes at the community and individual levels of analysis. For vaginal intercourse with main partners, this change consisted primarily of the formation of intentions to adopt consistent condom use. At baseline, most of the persons interviewed expressed no intention of using condoms with their main sex





**FIGURE 2—Mean stage-of-change scores for condom use with main and nonmain partners over time: CDC AIDS Community Demonstration Projects, 1991–1994.**

partners. Accordingly, most of the role-model messages encouraged recipients to begin considering this behavior. For condom use with nonmain partners, however, the intervention effect was largely attributable to changes in consistent condom use (i.e., movement into the action and maintenance stages). The pattern of these findings is consistent with findings of studies indicating that people may be reluctant to use condoms with their main, but not their nonmain, partners.<sup>52</sup>

The increases in self-reported stage of change for condom use are substantiated by corresponding changes in observed condom carrying. A strong intervention effect was seen for condom carrying in the community- and individual-level analyses. In fact, condom carrying increased by 74% in the intervention communities. This change is not only a verification of the self-reported changes in condom use but is important in itself. Carrying condoms is an especially important step toward risk reduction for persons who are likely to engage in sexual activity in settings where condoms are not readily available, such as sex workers.

Given the consistently positive influence of the intervention on all measures of

condom use, it is somewhat surprising that for bleach use a significant effect was observed only at the individual level, where recent exposure to the intervention was associated with stage-of-change scores. Statistical tests using the community as the unit of analysis, however, did not detect a significant intervention effect. This is primarily due to the fact that the bleach analysis was substantially underpowered. Statistical methods to determine power for community-level analyses have only recently been brought together by Murray.<sup>47</sup> As calculated by these methods, the post hoc estimate of power was 0.18. Thus, with 4 community pairs, we had only 18% power to reliably detect an intervention effect of 0.19 or larger.

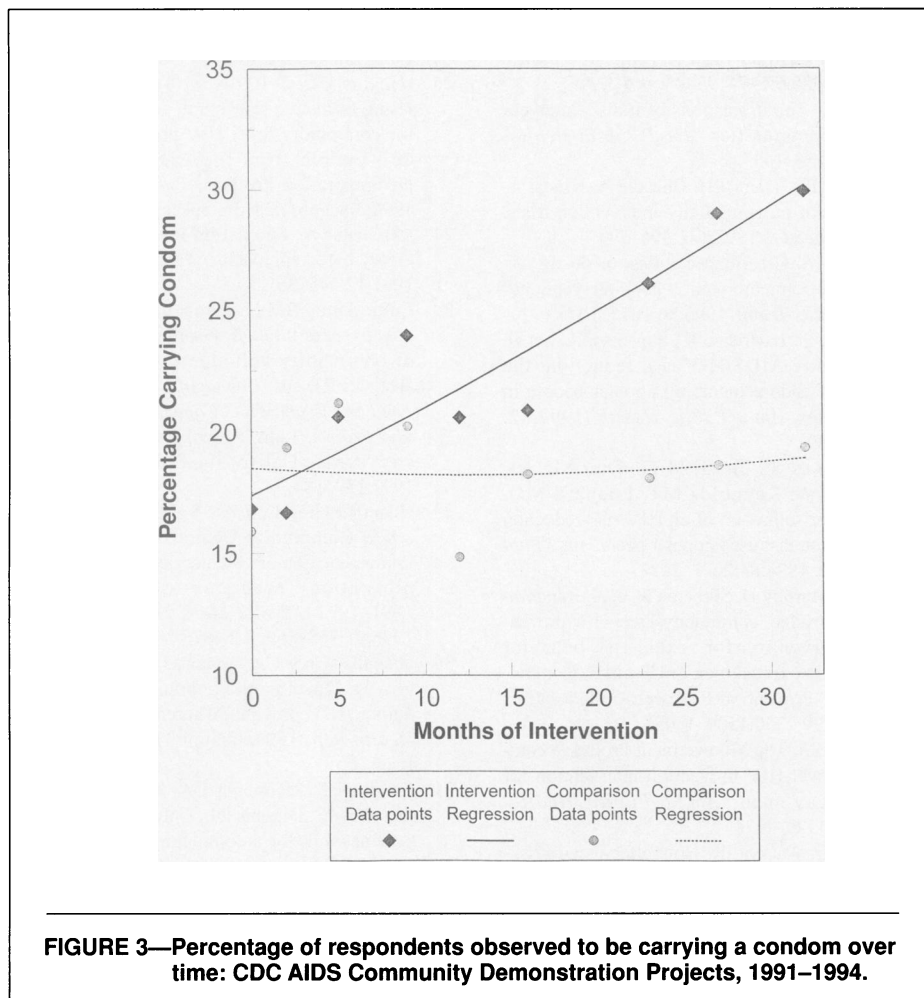
In addition, changes in recommendations regarding the use of bleach that were announced during the study may have limited the magnitude of the intervention effect.<sup>53</sup> When the federal guidelines recommending a hierarchy of steps that placed less emphasis on bleach use were issued, the messages provided by the AIDS Community Demonstration Projects were changed accordingly. Given that needle exchange programs were rare at the project sites and

that bleach use remained a viable prevention tool, bleach use was maintained as a primary outcome variable. The change in risk reduction messages, however, may have caused some injection drug users to adopt other risk reduction strategies that were not assessed as part of this study.

We believe that the use of the stages-of-change construct as a foundation of the intervention, as well as the outcome assessment, was critical to our success. As demonstrated in the baseline data, large proportions of the communities at risk were in the lower stages for consistent condom use with main and nonmain partners. With this information, we were able to develop and disseminate intervention messages that were more appropriate for facilitating movement from these early stages, for which “almost no meaningful interventions exist.”<sup>54</sup> Also, by using the stage-of-change model to assess intervention effectiveness, we were able to assess change across all transitions in adopting risk reduction behaviors. Traditional dichotomous outcome measures measure change for only one transition: from preparation to action—the point at which the person actually changes behavior. The stages-of-change model allowed us to capture the nuances of change.

Changes in stage-of-change scores, however, are difficult to interpret with regard to their potential impact on HIV transmission in a community. It is easier to understand the importance of the changes observed in this study if we consider only changes in the proportion of individuals reporting consistent condom use (i.e., those in the action or maintenance stages). In this study, the percentage of individuals in the intervention communities who reported consistent condom use with their main partners doubled, increasing from 8.5% at baseline to 17.0% at the last wave (Table 3). The percentage using condoms with nonmain partners increased from 25% to 33%. The combined magnitude of these effects is consistent with the magnitude observed in scientifically rigorous studies included in a recent meta-analysis of individual- and community-level HIV interventions conducted in the United States.<sup>55</sup> More important, it is clear that an increase of this magnitude can have a significant public health impact when considered at the community level.

This study had several limitations. With 2 exceptions, the community pairs were not randomly assigned to intervention or comparison status. Data collection methods did not include probability sampling; however, strategies such as the use of random number lists to select potential respondents were used in an attempt to reduce selection bias. The study communities were not assumed, however, to



**FIGURE 3—Percentage of respondents observed to be carrying a condom over time: CDC AIDS Community Demonstration Projects, 1991–1994.**

be a representative sample of a larger set of communities or populations at risk for HIV infection. Therefore, these findings should be viewed as an indication of what *can* occur with this type of community-level intervention and not as an indication of what would *necessarily* occur in other communities.

Our reliance on self-reported data was necessary because sexual activity and drug use are private behaviors. However, changes in self-reported condom use corresponded with those in observed condom carrying. Finally, although these analyses include adjustments for demographics, city, and type of community, they represent only an overview of the results from the projects. The effects of the intervention differed somewhat among sites and populations. Recent publications of findings from individual AIDS Community Demonstration Projects sites provide further information about the success of specific implementations of the intervention.<sup>44,56,57</sup>

This study and others demonstrate that community-level interventions can modify HIV risk behaviors.<sup>14,17,44,56–60</sup> It is important to recognize, however, that no single intervention can be 100% effective. The challenge now faced by HIV prevention

researchers and practitioners is to refine and integrate intervention efforts to optimize behavior change. Coordinating community-level interventions in a comprehensive HIV prevention plan with other, more intensive approaches, such as HIV counseling and testing and group interventions for skill building, may yield greater behavior change. Finally, community-level interventions may be enhanced by including structural factors that are indirectly related to HIV risk,<sup>61,62</sup> such as policies and laws regarding the availability of new syringes and needles;<sup>63–66</sup> opportunities for job training and placement (to provide financial alternatives to drug and sex trading); and solutions to broader social issues, such as discrimination and gender inequalities.<sup>67</sup> Unless society is willing to address these basic issues that sustain the HIV epidemic, most HIV prevention programs will achieve only limited success. □

## Contributors

M. Fishbein, D. L. Higgins, C. Rietmeijer, and R. J. Wolitski contributed to the intervention and evaluation design and implementation. C. A. Guenther-Grey oversaw intervention implementation. W. D. Johnson analyzed the data. All authors contributed to

data interpretation and the writing of the paper and are guarantors for the integrity of the research.

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