

Efficacy of a brief case management intervention to link recently diagnosed HIV-infected persons to care

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Objective: The Antiretroviral Treatment Access Study (ARTAS) assessed a case management intervention to improve linkage to care for persons recently receiving an HIV diagnosis.

Methods: Participants were recently diagnosed HIV-infected persons in Atlanta, Baltimore, Los Angeles and Miami. They were randomized to either standard of care (SOC) passive referral or case management (CM) for linkage to nearby HIV clinics. The SOC arm received information about HIV and local care resources; the CM intervention arm included up to five contacts with a case manager over a 90-day period. The outcome measure was self-reported attendance at an HIV care clinic at least twice over a 12-month period.

Results: A higher proportion of the 136 case-managed participants than the 137 SOC participants visited an HIV clinician at least once within 6 months [78 versus 60%; adjusted relative risk (RR_{adj}), 1.36; $P = 0.0005$] and at least twice within 12 months (64 versus 49%; RR_{adj}, 1.41; $P = 0.006$). Individuals older than 40 years, Hispanic participants, individuals enrolled within 6 months of an HIV-seropositive test result and participants without recent crack cocaine use were all significantly more likely to have made two visits to an HIV care provider. We estimate the cost of such case management to be US\$ 600–1200 per client.

Conclusion: A brief intervention by a case manager was associated with a significantly higher rate of successful linkage to HIV care. Brief case management is an affordable and effective resource that can be offered to HIV-infected clients soon after their HIV diagnosis.

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Introduction

One of the largest and relatively unrecognized problems in the US HIV/AIDS epidemic is that, of the roughly 670 000 living adults who know they are HIV-infected, an estimated one-third are not receiving care [1]. This is in large part because many who are diagnosed with HIV delay entering care for more than 1 year after their diagnosis [2]. Delays in obtaining HIV care are frequent, as evidenced by the numbers of patients who enter care when they are ill or have CD4+ T-lymphocyte counts below 200×10^6 cells/l [3,4]. As the percentage of HIV-infected persons who are aware of their status increases, through greater testing or better return rates due to use of rapid testing, barriers and delays in seeking HIV care become more important. Delays in seeking care have obvious implications both for the treatment and prognosis of HIV-infected patients, and for the further propagation of the epidemic [5]. In recognition of this problem, the Centers for Disease Control and Prevention (CDC) has identified as a primary strategic prevention objective increasing the proportion of HIV-infected persons who are linked to appropriate care, prevention services and treatment soon after receiving a positive HIV test result [6].

Previous studies have documented the myriad factors including financial, geographic, educational and mental health barriers that have impeded persons living with HIV from entering HIV primary care [7,8]. However, we are not aware of any intervention that concerns evaluating linkage to primary HIV care in a randomized controlled trial. We hypothesized that entry into care of recently diagnosed persons could be achieved with a brief, focused, case management intervention compared with a simple referral for services. Within this context, the Antiretroviral Treatment Access Study (ARTAS) evaluated a brief case management intervention to link HIV-infected persons to HIV care, and to sustain this linkage for more than a single visit.

Methods

Sites and participants

In conjunction with the CDC, four sites conducted ARTAS: University of Miami, Miami; Johns Hopkins Bloomberg School of Public Health, Baltimore; Health Research Association, Los Angeles; and Emory University School of Medicine, Atlanta. Collaborators at Wright State University, Dayton, Ohio assisted in the development of the intervention. We began enrolling participants in March 2001 and completed enrollment on 31 May 2002. Participants completed a baseline audio-computer assisted self-interview (ACASI) instrument and were scheduled for 6- and 12-month follow-up interviews. The conduct of this study and its consent forms were regularly reviewed

and approved by institutional review boards at CDC and the four ARTAS sites.

Eligibility requirements included that participants recently tested HIV-positive; were age 18 years or older; had been to a care provider no more than once in the past and not on antiretrovirals; and able to sign informed consent. Participants were recruited as early as possible after a positive HIV test; ideally within 6 months after diagnosis. In the last 7 months of recruitment, eligibility was expanded to allow individuals to enroll whose positive HIV test was older than 6 months. Participants were recruited from a variety of sources, including health department testing centers, STD clinics, hospitals, and community-based organizations. The recruiters did not directly approach potential participants; instead, clinic and agency personnel provided potential participants with brief information about the study and then referred interested participants to study recruiters.

Intervention and randomization

Participants were randomized to case-management (intervention) or passive referral (standard of care). The case-management intervention was conceived as time-limited assistance to link HIV-infected individuals to HIV care providers. Conceptually, it is an alternative to a simple, single referral that typically occurs at the end of counseling after a positive HIV test. ARTAS case management was modeled on strengths-based case management [9–11], which asks clients to identify their internal strengths and assets and apply these to acquire needed resources. This approach borrows from theories of empowerment and self-efficacy [12,13], which makes the intervention particularly appropriate for people who are largely disenfranchised. An intervention manual was developed and ARTAS case managers were trained as a group before clients were enrolled. Thereafter, they were supervised locally by senior staff at each site.

At the time of the study entry visit, participants gave their consent and completed an ACASI interview. Participants were then randomized in a 1 : 1 fashion using a block size of six from sealed envelopes. Both groups received standard CDC-produced informational pamphlets about HIV and information on local care resources. The standard-of-care (SOC) arm received only this information and a referral to a local HIV medical care provider. Participants randomized to the intervention arm were introduced to the case manager. The intervention arm allowed up to five case management contacts per client. The first three contacts consisted of building the relationship, identifying and addressing client needs and barriers to health care, and encouraging contact with a clinic. If needed, a fourth and fifth interaction involved encouraging contact with a clinic, and accompanying the client to the clinic. All case-management contacts were required to be completed within 90 days after randomization and no further contacts between the case manager and

the client were permitted for the duration of the study. Clients who did not appear for scheduled appointments were re-contacted for 30 days only.

Outcome definition

The primary outcome measurement for the intervention was self-reported attendance at an HIV-care provider at least once in each of two consecutive 6-month periods; namely in-care twice within 12 months of observation. We reviewed medical clinic records to verify the self-reported attendance at HIV care providers in each of the time periods. Participants with complete outcome data over 12 months ($n = 273$) were included in the main analysis of the effects of case management. Data were analyzed by intention to treat principles: all were analyzed in the randomization group to which they were originally assigned, including 24 participants who failed to keep any appointments with the case manager.

Other variables

All independent variables were from the baseline study visit. These variables included: trial randomization arm; age at enrollment; gender; race/ethnicity; income; study site; AIDS symptoms; non-ARTAS assistance in obtaining HIV care (counselor, social worker, case manager or other person); expressed likelihood of starting care in the next 30 days; time since HIV diagnosis; HIV knowledge, and attitudes and beliefs (KAB) about HIV and HIV treatment divided into tertiles of a KAB score; recent injection drug use (last 30 days); recent crack use (last 30 days); and recruitment location.

Other assessments – costs

A major concern was that the case management intervention should not be so expensive that it would prohibit uptake by local agencies after study completion. We report actual annual program costs for the workload experienced during the intervention trial and also annual costs for a typical case manager workload of 30 clients per quarter, or 120 clients per year. In these costs we included reported salary and benefits for case managers and supervisors, costs of transportation, telephones, office supplies, rent and overhead, based on 2002 dollars.

Other assessments – HIV RNA viral load

The Roche Amplicor HIV-1 Monitor test (Roche Diagnostics, Indianapolis, Indiana, USA), with a lower limit of detection at 400 copies/ml was used on centrally processed plasma samples. Missing data for HIV-RNA viral load precluded using these data for the main outcome analysis. However, we did perform a sub-analysis for plasma HIV RNA viral load in those participants with HIV RNA viral load data at baseline and 12 months. We compared \log_{10} viral load baseline values with 12-month values for case management (CM) and standard of care (SOC) participants stratified by those linked to care and those not linked to care. Statistical

comparisons were reported from a two-sample *t*-test on means; observations with missing data were dropped.

Statistical analysis

Logistic regression was used (SAS version 8.2; SAS Inc., Cary, North Carolina, USA) to estimate odds ratios for the effect of CM versus SOC associated with receiving HIV care within 6 and 12 months, adjusting for all other variables. We also estimated odds ratios stratified by the number of CM versus SOC contacts. As the incidence of linkage to care was consistently above 40%, to correct for overestimation by odds ratios when incidence is high, we report adjusted relative risks (RR) using the formula $RR = OR / [(1 - P_0) + (P_0 \times OR)]$, where OR is the odds ratio and P_0 is the incidence in the standard of care group [14]. With the exception of gender and study site, all variables included in the multivariable model had a significance level ≤ 0.20 in univariate analyses.

Relative risks where all individuals missing outcome data were assumed not to be in care are also reported to illustrate how assumptions about missing data affect the results. In addition, we performed a supplementary analysis ($n = 289$) that imputed missing data for 16 individuals with partial outcome data. For that analysis we report results on three independent variables with borderline significance in the main analysis. For these 16 individuals we used a 'hot deck' method to randomly select an outcome variable value from participants with complete data and assigned those values to the 16 persons without complete information [15].

Sample size assumptions

We assumed an absolute difference of 15 to 20% in linkage to care rates would be scientifically meaningful, and that the success rate in the CM group might be between 75 and 80%. Further assuming a 20% loss to follow-up, we calculated the sample size needed for two proportions to be statistically significant at $P = 0.05$ and a power of 80% would be between 295 and 460 participants.

Results

Participants

The overall follow-up rate was 273 of 316 (86%). A total of 27 (9%) participants were excluded because they were missing both 6- and 12-month follow-up data; 16 participants (5%) were also excluded who had 6-month data but were missing 12-month interviews (Fig. 1). Participants with complete follow-up data were similar to the 43 without complete follow-up data on age group ($P = 0.43$), time since diagnosis ($P = 0.64$), and randomization group ($P = 0.90$), but not for race ($P = 0.01$). Fewer whites (7 versus 18%) and more Hispanics (29 versus 12%) were included in the complete data compared with the 43 without complete data.

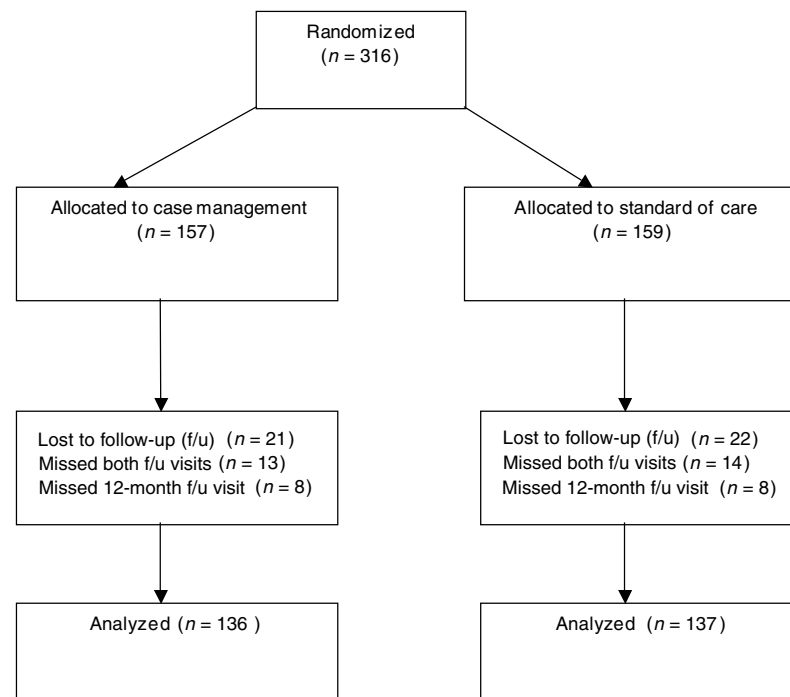


Fig. 1. Flow diagram for the Antiretroviral Treatment Access Study participants.

Table 1 shows the distribution of selected characteristics for the CM and SOC participants. The SOC participants had slightly higher levels of 'non-ARTAS assistance with HIV care' than the CM participants, and the distribution of responses on 'likely to start care' differed from the CM participants (Table 1). More than 40% were recruited from public health department-sponsored clinics or testing and counseling locations. Participants were socio-economically disadvantaged – 91% reported annual personal income below US\$ 20 000, and 85% reported using public funds or public health insurance (e.g., Medicare or Medicaid).

Contacts with the case manager

Of 136 CM participants, there were a total of 350 face-to-face contacts (average 2.6 per participant). These formal contacts were in-person; most were at the case manager's office or at the HIV clinic referred to. Telephone contacts were permitted but were brief, usually to schedule the next contact.

Multivariate analysis of successful linkage to care

A higher proportion of the 136 CM participants than the 137 passively referred participants made a visit to an HIV clinician at least once within the first 6 months follow-up period [78 versus 60%; adjusted relative risk (RR_{adj}), 1.36; $P = 0.0005$]. The critical primary outcome of the trial revealed that a higher proportion visited an HIV clinician at least twice within 12 months (64 versus 49%; RR_{adj} , 1.41; $P = 0.006$). As the main outcome measure of the ARTAS study was the linkage resulting in at least two visits to an HIV care provider over

12 months, the subsequent analyses focused on this outcome.

Table 2 shows the adjusted relative risks of participants reporting attendance at an HIV care provider at both 6 and 12 months, adjusting for all other variables in a logistic regression model. The number of contacts (i.e., one, two, three, etc.) with the case manager yielded some equivalent contrasts with the SOC participants. When the CM participants were stratified according to number of contacts with the case manager, the relative risk versus SOC was highly significant in the 93 CM participants with two or more contacts with the case manager (RR_{adj} , 1.48; $P = 0.004$); of similar size in those 19 with a single contact (RR_{adj} , 1.53; $P = 0.09$); but clearly not significant in those 24 with zero formal contacts with the case manager (RR_{adj} , 1.08; $P = 0.88$). Further analyses of the 93 participants with two or more contacts indicated that the relative risk was about the same for two or three contacts and four or five contacts.

A significantly higher proportion of participants diagnosed with HIV in the past 6 months (62%) reported HIV care at both time periods than those whose diagnosis was more than 6 months from study entry (36%). We also observed a 60% increase in linkage-to-care rates for those with a shorter time since diagnosis; a 40% increase in in-care rates for those receiving non-ARTAS assistance; a 40% increase in care rates for non-users of crack cocaine; and a 50% increase in care rates for participants aged 40 years or older compared with those aged 18 to 25 years.

Table 1. Baseline characteristics of ARTAS participants by intervention arm.

	Intervention arm		χ^2	P-value
	Simple referral (n = 137) n (%)	Case management (n = 136) n (%)		
Age (years)			1.24	0.54
40 or more	52 (38.0)	49 (36.0)		
26–39	67 (48.9)	74 (54.4)		
18–25	18 (13.1)	13 (9.6)		
Gender			0.19	0.66
Male	99 (72.3)	95 (69.9)		
Female	38 (27.7)	41 (30.1)		
Race/ethnicity			1.53	0.67
Black non-Hispanic	83 (59.3)	73 (53.7)		
White non-Hispanic	8 (6.9)	11 (8.1)		
Hispanic	38 (27.6)	42 (30.9)		
Other	8 (6.2)	10 (7.3)		
Study site			0.46	0.93
Los Angeles	42 (30.7)	42 (30.9)		
Atlanta	28 (20.4)	32 (23.5)		
Baltimore	29 (21.2)	27 (19.9)		
Miami	38 (27.7)	35 (25.7)		
AIDS symptoms			0.15	0.93
Three or more	34 (24.8)	36 (26.5)		
One or two	55 (40.2)	55 (40.4)		
Zero	48 (35.0)	45 (33.1)		
Log ₁₀ HIV RNA viral load mean (\pm SEM)	4.52 (0.08)	4.53 (0.07)	0.14 ^b	0.89
Non-ARTAS assistance in obtaining HIV care			5.74	0.06
Much	4 (2.9)	8 (5.9)		
Some	27 (19.7)	14 (10.3)		
None	106 (77.4)	114 (83.8)		
Time since diagnosis to study entry			1.10	0.29
\leq 6 months	110 (80.3)	102 (75.0)		
>6 months	27 (19.7)	34 (25.0)		
Income			4.65	0.32
US\$ 0 to US\$ 5000	68 (49.6)	73 (53.7)		
US\$ 5001 to US\$ 10000	36 (26.3)	23 (16.9)		
US\$ 10001 to US\$ 20000	24 (17.5)	25 (18.4)		
US\$ 20001 to US\$ 30000	6 (4.4)	9 (6.6)		
US\$ 30001 or more	3 (2.2)	6 (4.4)		
Injected drugs last 30 days			0.00	0.98
Yes	14 (10.2)	14 (10.3)		
No	123 (89.8)	122 (89.7)		
Used crack cocaine last 30 days			0.89	0.35
Yes	26 (19.0)	20 (14.7)		
No	111 (81.0)	116 (85.3)		
Likely to start care next 30 days?			6.19	0.05
Extremely likely	61 (46.5)	70 (51.5)		
Fairly or very likely	60 (44.8)	43 (31.6)		
Extremely or fairly unlikely	13 (9.7)	23 (16.9)		
HIV knowledge, attitudes and beliefs (KAB)			4.06	0.13
KAB High tertile	41 (30.1)	33 (24.3)		
KAB Middle tertile	62 (45.6)	55 (40.4)		
KAB Low tertile	33 (24.3)	48 (35.3)		
Recruitment location			10.42	0.23
Public health clinics/testing centers	68 (49.6)	62 (45.6)		
Hospital inpatient	9 (6.6)	13 (9.6)		
Community organization	6 (4.4)	9 (6.6)		
Emergency room/walk-in clinic	6 (4.4)	12 (8.8)		
Other research study	14 (10.2)	15 (11.0)		
Drug treatment center	9 (6.6)	4 (2.9)		
Advertisement	12 (8.7)	4 (2.9)		
Self-referral	9 (6.6)	10 (7.4)		
Other/missing ^a	4 (2.9)	7 (5.2)		

^aPrivate physician, blood bank, jail, or missing. ^bt-test on means. ARTAS, Antiretroviral Treatment Access Study.

Table 2. Adjusted relative risks of successful linkage to HIV care by study arm and selected characteristics.

	<i>n</i> (%) in care at both 6 and 12 months	Adjusted ^b relative risk (95% confidence interval)	<i>P</i> -value
Intervention arm			
Case management (CM)	87 (64)	1.41 (1.1–1.6)	
Simple referral (SOC)	67 (49)	ref.	0.006
Age (years)			
40 or more	60 (59)	1.5 (1.1–1.8)	0.02
26–39	78 (55)	1.2 (0.8–1.6)	0.28
18–25	16 (52)	ref.	
Gender			
Male	114 (59)	1.0 (0.7–1.4)	0.83
Female	40 (51)	ref.	
Race/ethnicity			
White non-Hispanic	12 (63)	1.3 (0.7–1.8)	0.37
Hispanic	62 (78)	1.7 (1.3–2.0)	0.002
Other	7 (39)	1.2 (0.6–1.8)	0.55
Black non-Hispanic	73 (47)	ref.	
Study site			
Los Angeles	60 (71)	0.8 (0.5–1.3)	0.48
Atlanta	35 (58)	1.1 (0.6–1.5)	0.80
Baltimore	21 (38)	0.9 (0.4–1.4)	0.62
Miami	38 (52)	ref.	
AIDS symptoms			
Three or more	43 (61)	1.3 (0.9–1.6)	0.21
One or two	64 (58)	1.2 (0.9–1.5)	0.24
Zero	47 (51)	ref.	
Non-ARTAS assistance in obtaining HIV care			
Much	8 (67)	1.0 (0.4–1.6)	0.95
Some	30 (73)	1.4 (1.0–1.6)	0.06
None	116 (53)	ref.	
Time since diagnosis to study entry			
≤6 months	132 (62)	1.6 (1.0–2.1)	0.05
>6 months	22 (36)	ref.	
Income			
US\$ 0 to US\$ 5000	70 (50)	ref.	
US\$ 5001 to US\$ 10000	34 (58)	1.0 (0.6–1.3)	0.82
US\$ 10001 to US\$ 20000	39 (80)	1.5 (1.1–1.8)	0.02
US\$ 20001 to US\$ 30000	7 (47)	0.9 (0.4–1.5)	0.78
US\$ 30001 or more	4 (44)	0.9 (0.1–1.9)	0.88
Injected drugs last 30 days			
No	145 (59)	1.2 (0.6–2.1)	0.60
Yes	9 (32)	ref.	
Used crack cocaine last 30 days			
No	136 (60)	1.4 (0.9–1.9)	0.08
Yes	18 (39)	ref.	
Likely to start care next 30 days?			
Extremely likely	83 (62)	1.2 (0.8–1.7)	0.36
Fairly or very likely	54 (52)	1.2 (0.8–1.7)	0.35
Extremely or fairly unlikely	17 (47)	ref.	
HIV knowledge, attitudes and beliefs (KAB)			
KAB High tertile	49 (66)	1.4 (0.9–1.7)	0.10
KAB Middle tertile	65 (56)	1.0 (0.7–1.4)	0.85
KAB Low tertile	40 (49)	ref.	
Recruitment location			
Public health clinics/testing centers	83 (64)	0.8 (0.4–1.3)	0.35
Hospital inpatient	13 (59)	0.7 (0.2–1.4)	0.39
Community organization	7 (47)	0.5 (0.2–1.3)	0.13
Emergency room/walk-in clinic	12 (67)	1.0 (0.3–1.7)	0.99
Other research study	9 (31)	0.6 (0.2–1.1)	0.16
All other ^a	30 (51)	ref.	

^aDrug treatment center, advertisement, self-referral, private physician, blood bank, jail, or missing. ^bEach variable adjusted for all other variables in the table. ARTAS, Antiretroviral Treatment Access Study.

Medical records review

To verify that these results were not due to differential ascertainment or recall, clinic medical records were reviewed. For participants completing the 6-month interview 164 (93%) of 177 reporting HIV care could be confirmed; medical records did not confirm for three (2%), and for 10 (5%) no medical record was located. Rates of confirmation at 6 months were similar between the CM (92%) and the SOC referrals (93%). For those participants completing the 12 month interview, confirmation by medical records was 165 (86%) of 192 reporting HIV care; medical records did not confirm for seven (4%), and for 20 (10%) no medical record was located. Rates of confirmation at 12 months were similar between the CM (84%) and the SOC referrals (87%). When the logistic regression was restricted to only those cases confirmed by medical records, the effect of CM was unchanged (RR_{adj} , 1.36; $P = 0.02$).

Effect of missing data assumptions

Our analysis based on participants with complete follow-up data ($n = 273$) showed an adjusted relative risk of 1.41 for those receiving CM versus SOC (Table 2). Of the originally randomized 316, 43 did not complete follow-up visits (Fig. 1). The proportions of missing data were, case management: 21 of 156 (13.4%); SOC: 22 of 159 (13.8%). When the 43 participants missing either 6-month or 12-month interviews were assumed not to be in care (that is, analyzing all 316 participants) this gave an RR_{adj} of 1.40 ($P = 0.003$). Thus, regardless of the method we chose to handle missing data, the estimates of RR_{adj} were essentially identical.

A supplementary analysis in which missing data were imputed for 16 participants who did not have 12-month data yielded narrower confidence limits for three variables with borderline significance in the main analysis: ≤ 6 months versus > 6 months since diagnosis [RR_{adj} , 1.6; 95% confidence interval (CI), 1.1–2.1]; receiving non-ARTAS assistance (RR_{adj} , 1.4; 95% CI, 1.1–1.7); and recent crack cocaine non-use versus use (RR_{adj} , 1.3; 95% CI, 1.0–1.4).

Program cost

For 156 clients enrolled into the CM arm, the average program cost over 54 weeks involving client activity was US\$ 1171 per client and US\$ 7807 per additional client linked to care beyond expected under the standard of care. This was actual program cost, based on approximately five clients per month. We estimated that case managers could comfortably handle 10 clients per month or 120 clients per year, and that this would reduce the average per-client cost to about US\$ 599 per client and about US\$ 3993 per additional client linked to care beyond the number expected under the standard of care.

Changes in HIV RNA viral loads

For the 121 participants with viable plasma samples at baseline and 12 months, both CM and SOC participants

linked to care at 6 and 12 months had significant reductions in \log_{10} viral load, 4.75 versus 4.30; $P = 0.02$, and 4.62 versus 4.37; $P = 0.02$, respectively. These changes represented an absolute drop of 0.45 log in CM and 0.25 log in SOC. For participants not linked to care, no significant reductions were observed in CM (4.39 versus 4.51; $P = 0.73$) or SOC participants (4.44 versus 4.18; $P = 0.11$).

Discussion

In this randomized trial of recently diagnosed HIV-infected persons from urban US locations, we found that a brief CM intervention that relied on client strengths resulted in a 40% relative increase and 15% absolute increase linkage to HIV care at 6 and 12 months. Our intervention, which emphasized cost-efficiency, limited the case management to no more than five contacts within a 90-day period. This innovation may be of reasonable cost and broadly useful for local, state and federal public health agencies charged with reducing HIV morbidity and mortality, and with controlling the spread of HIV in the US. Because our SOC arm received a standardized referral in addition to any referral they received at post-test counselling; namely a double dose of this information in many cases, our estimate of efficacy may underestimate effect sizes that could occur in non-research settings.

The rationale for using linkage case managers instead of passive referral is suggested by multiple studies showing the HIV/AIDS epidemic in the US to be increasingly a problem of disadvantaged, multiple-needs populations [3,6]. These populations – those with marginal or no health insurance, homeless, or low incomes – have been shown to have reduced unsatisfied needs and higher use of antiretrovirals when they are provided with a case manager once they are actually in HIV care [16]. What has not been clearly demonstrated in previous studies is whether a CM intervention shortly after diagnosis rather than a simple referral would more successfully link primarily disadvantaged and disenfranchised HIV-infected persons into care.

Linking HIV-positive persons into care and antiretroviral treatment is a fundamental HIV prevention strategy. A concerted effort by CDC to bring HIV testing into more non-traditional settings and make it more routine in medical settings [17] focuses attention on what happens to those clients after they test HIV positive. In comparison with prevention activities occurring within the clinic, the problem of linking persons into the clinic has been less studied. Unlike patient-specific factors that are often difficult to address, brief case management is a tangible resource available to public health authorities that can be offered at a reasonable cost. Clients who followed through with one or more formal contacts with the case manager

had significant benefits. We did find factors other than ARTAS case management that were also associated with increased use of HIV primary care. Most important among these were time from diagnosis to study entry and recent use of crack cocaine. Thus, our data suggests that this intervention could be more successful if implemented soon after HIV diagnosis (less than 6 months after test date). This characteristic may be partially under the control of health authorities if rapid HIV testing results in better return rates for clients receiving positive test results [18–20]. Less delay in accessing first HIV medical care in older individuals has also been previously reported [21]. Use of crack cocaine also appears to inhibit successful linkage to HIV care; few studies have evaluated crack use, but several reports have linked injection drug use with delayed care entry [2,22]. Crack users were difficult to link to care and specialized interventions may need to be developed for crack users that also provide linkage to drug treatment.

Although this study was designed as a randomized clinical trial, it had several limitations that were mainly related to its necessary conduct outside of the hospital or clinic setting. First, self-report of linkage to HIV care was used as the main outcome. Although self-report can be unreliable, we observed the same relative risks when we restricted the analysis to outcomes confirmed by medical records. We used audio computer-assisted self-interviewing to obtain responses, which has shown improved validity and reliability in comparison with personal interviewing [23,24]. ARTAS was developed and tested in four highly urbanized locations with many HIV care providers available within the metropolitan areas, so we do not know yet whether it would be practical or cost-efficient to deliver such an intervention in locations with low population densities. Linkage to two visits alone does not ensure a patient will remain in care. However, other broadly representative but non-randomized studies have already shown that in disadvantaged populations contact with a clinical case manager does improve retention in care and use of antiretrovirals [16]. Additional interventions may be required once patients enter care to ensure that they remain in care and fully benefit from available treatment and preventive services. There are other avenues to improve care-seeking which we did not pursue, such as providing CD4 cell count and viral load at the time HIV test results are given.

In summary, these data indicate that a relatively modest investment in case management resulted in significantly improved use of HIV care over 12 months in recently diagnosed HIV-infected persons. Brief case management is thus a tangible and affordable resource that can be offered to HIV-infected clients soon after diagnosis. Such a resource could be implemented by local health authorities in combination with rapid HIV tests, HIV testing and education campaigns and clinical case managers to significantly reduce HIV morbidity and HIV transmission.

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Appendix

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