The Effectiveness of Assertive Community Treatment for Homeless Populations With Severe Mental Illness: A Meta-Analysis

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Objective: The purpose of this study was to assess the effectiveness of assertive community treatment in the rehabilitation of homeless persons with severe mental illness using a meta-analysis.

Method: A structured literature search identified studies for review. Inclusion criteria were the use of an assertive community treatment-based rehabilitation treatment in an experimental or quasi-experimental model, exclusive treatment of homeless subjects, and follow-up of housing and psychiatric outcomes. Two reviewers independently abstracted data on methodology and outcomes from included studies. The authors calculated effect differences, summary effects and confidence intervals (CIs) for housing, and hospitalization and symptom severity outcomes.

Results: Of the 52 abstracts identified, 10 (19%) met inclusion criteria. Of these, six were randomized controlled trials, and four were observational studies, totaling 5,775 subjects. In randomized trials, assertive community treatment subjects demonstrated a 37% (95% CI=18%–55%) greater reduction in homelessness and a 26% (95% CI=7%–44%) greater improvement in psychiatric symptom severity compared with standard case management treatments. Hospitalization outcomes were not significantly different between the two groups. In observational studies, assertive community treatment subjects experienced a 104% (95% CI=67%–141%) further reduction in homelessness and a 62% (95% CI=0%–124%) further reduction in symptom severity compared with pretreatment comparison subjects.

Conclusions: Assertive community treatment offers significant advantages over standard case management models in reducing homelessness and symptom severity in homeless persons with severe mental illness.

Several evidence-based interventions have demonstrated efficacy in treating severe mental illness (1). The most aggressively studied model of case management is assertive community treatment, derived from the work of Stein and Test (2). Assertive community treatment is distinguished from traditional approaches by the following features: a multidisciplinary team, low client/staff caseloads that enable more intensive contact, community-based services that are directly provided rather than brokered to other organizations, and 24-hour coverage by the treatment team (1–4). The superiority of assertive community treatment compared with other case management models is well documented. A number of studies, including several meta-analyses, demonstrate statistically significant advantages of assertive community treatment in substantially reducing the length and frequency of hospitalization and increasing independent living while moderately improving psychiatric symptoms and quality of life for persons with severe mental illness (4–9). While assertive community treatment is more costly to administer than other case management treatments, studies have found that it is more cost-effective because of a reduced utilization of hospitalization and emergency services (4, 10).

While evidence supports the effectiveness of assertive community treatment in treating persons with severe mental illness, less is known about its effects in specific subpopulations that present particular challenges for engagement or recovery (8). One such subgroup is the homeless mentally ill. The homeless population in all cities of the United States exceeds 200,000, and an estimated 14 million Americans experience at least one episode of homelessness during their lifetime (11, 12). Among these individuals, 20% to 35% suffer from severe mental illness (13). They also experience higher rates of substance abuse and criminal justice involvement (14). As a result, this is a particularly challenging group for the mental health service system to engage and assist.

Identifying a best practice may help to improve the quality of care for the homeless mentally ill. There is no consensus regarding the best treatment; therefore, we sought to determine whether current evidence supports the use of assertive community treatment over other case management models in this population. We conducted a meta-analysis to test the hypothesis that assertive community treatment is more ef-

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TABLE 1. Characteristics of Studies in a Meta-Analysis Examining the Effectiveness of Assertive Community Treatment and Standard Case Management in the Treatment of Homeless Mentally Ill Adults

Study Design	N	Mean Age (years)	Male Sex (%)	Caucasian Race (%)	Treatment Group	Comparison Group	Follow-Up Months	Enrollment	Potential Limitations
		Cohort Characteristics							
Randomized controlled trials									
Clarke et al. (18)	163	36.5	61	82	Assertive community treatment +/–consumer team member (N=114)	Standard case management (N=49)	6–24	178 subjects randomized; 15 lost to follow-up	Some assertive community treatment services available to comparison subjects; documented low fidelity to assertive community treatment in experimental subjects; variable follow-up period
Lehman et al. (3)	152	38	68	24	Assertive community treatment (N=77)	Standard case management (N=75)	12	Randomization stratified on referral source (hospital or community)	Comparison subjects had access to assertive community treatment in area; missing data interpolated; more women refused to participate
Morse et al. (19)	165	35	58	45	Assertive community treatment +/– community workers (N=110)	Brokered case management (N=55)	18	Randomization not described	Subjects at risk for homelessness (not currently homeless) included; 33% no-show rate in comparison group
Morse et al. (20)	178	34	58	47	Intensive case management[a] (N=52)	Standard case management or drop-in center (N=126)	12	150 subjects randomized	No differential effects from attrition; subjects lost to follow-up were replaced
Korr and Joseph (24)	114	37	78	43	Bridge model outreach[a] (N=48)	Standard services (N=47)	6–12	19 at-risk homeless subjects not randomized (excluded from meta-analysis)	Small cohort size; some clients have only substance disorder; missing subjects counted as not hospitalized
Shern et al. (25)	168	40	76	29	Choices outreach program[a] (N=91)	Standard treatment (N=77)	24	Randomization not described but effective (no difference between groups)	Increased attrition in comparison groups
Observational studies									
Lam and Rosenheck (17)	4,631	38.5	63	50	Post-assertive community treatment, referred from street outreach (N=364) or social agency (N=4,267)	Pre-assertive community treatment baseline assessment (N=4,631	3	5,431 enrolled; 844 lost to follow-up at 3 months	Prospective cohort study; no non-assertive community treatment comparison group; short follow-up
Morris and Warnock (26)	50	40	54	62	Mobile Outreach Community Services[a] clients (N=25)	Pre-Mobile Outreach Community Services assessment (N=25)[b]	N/A	Treatment group randomly selected from clients who had completed treatment in recent years	Time-lag study; raters blinded to group assignment
Meisler et al. (27)	114	39	56	47	Training in Community Living[a] (N=114)	Pre-Training in Community Living Assessment (N=114)	12	All subjects enrolled at hospital or prison discharge	Retrospective case study—no comparison group
Wasylenki et al. (28)	59	38	58	68	Post-assertive community treatment (N=59)	Pre-assertive community treatment baseline (N=59)	9	Subjects referred from a hostel. Women, older patients more likely to refuse enrollment	Prospective cohort study; subjects chronically homeless (mean=8.8 years)

[a] Study cites treatment based on principles of assertive community treatment.
[b] Comparison subjects different from treatment group.

TABLE 2. Individual Study Responses, Heterogeneity Findings, and Summary Effects for Homelessness Outcome Measures by Study Design

Study Design	Measure	Comparison/Pre-Intervention (mean or prevalence)	Assertive Community Treatment/Post-Intervention (mean or prevalence)	Effect Difference	Analysis 95% CI	SE	Weight
Randomized controlled trials[a]							
Clarke et al. (18)	Percentage experiencing any homelessness	18% (N=9 of 49)	22% (N=25 of 114)	–4%	–17%–9%	0.07	24.66
Lehman et al. (3)	Mean days of homelessness on the street	Mean=24.3 (SD=45.9)	Mean=10.1 (SD=45.6)	31%	0%–63%	0.16	15.97
Morse et al. (19)	Change in mean days not in stable housing	Mean=–9.73 (SD=14.77)	Mean=–15.58 (SD=12.20)	42%	9%–75%	0.17	15.67
Morse et al. (20)	Change in mean days of homelessness (past month)	Mean=–16.02 (SD=12.15)	Mean=–22.34 (SD=9.32)	62%	29%–95%	0.17	15.57
Korr and Joseph (24)	Percentage not in active housing (6 months)	68% (N=32 of 47)	25% (N=12 of 48)	43%	25%–61%	0.09	22.46
Shern et al. (25)	Change in percent time spent on the streets	Mean=–28.2% (SD=44.5)	Mean=–54.9% (SD=36.9)	65%	34%–96%	0.16	16.33
	Summary effect[b]			37%	18%–55%	0.10	
Observational studies[c]							
Lam and Rosenheck (17)	Mean days of homelessness (past 2 months)	Mean=37.9 (SD=20.8)	Mean=21.0 (SD=25.0)	73%	69%–77%	0.02	8.79
Morris and Warnock (26)	Mean days of homelessness (past 6 months)	Mean=75.78 (SD=72.99)	Mean=11.54 (SD=30.26)	113%	53%–173%	0.31	4.82
Meisler et al. (27)	Percentage experiencing any homelessness	100% (N=114 of 114)	29% (N=22 of 114)	81%	61%–101%	0.10	8.10
Wasylenki et al. (28)	Number of weeks in shelters (past 9 months)	Mean=24.7 (SD=9.6)	Mean=83.0 (SD=9.4)	171%	129%–214%	0.22	6.24
	Summary effect[b]			104%	67%–141%	0.19	

[a] Heterogeneity: χ^2=11.17, df=5, p<0.05.
[b] Random effects method used because of statistical heterogeneity.
[c] Heterogeneity: χ^2=22.59, df=3, p<0.001.

fective than other case management models in reducing homelessness, hospitalization, and symptom severity outcomes in homeless persons with severe mental illness.

Method

Study Selection

We performed a standardized search of abstracts in MEDLINE (1966–2003), PubMed (1950–2003), the Cochrane Database of Systematic Reviews, and PsycINFO (1974–2003) databases. The search involved the intersection of the following three topic areas: assertive community treatment (keywords: assertive community treatment or case management or intensive case management), severe mental illness (keywords: severe mental illness or community mental health services or psychotic disorders or schizophrenia), and homelessness (keywords: homeless persons or homeless or homelessness). Citations from two substantial reviews of assertive community treatment or community programs for homeless persons were also examined (8, 15). Several principal investigators were contacted regarding unpublished data. We examined studies for the following inclusion criteria: experimental or observational design; subjects limited to homeless persons with a severe mental

illness, but not limited to addictive disorders alone; use of assertive community treatment or an assertive community treatment-based treatment; and report of the outcomes of interest (housing plus hospitalization and/or symptom severity). We set no limits on cohort size or length of follow-up.

Data Abstraction

Authors independently used a standardized data abstraction instrument to extract data from the included studies. Abstracted data consisted of the study design, cohort size, treatment versus comparison groups, measurement methods, and effect size with variance for the three outcome variables. Because of heterogeneity of measures across studies, we performed basic data transformation in order to create linearly equatable outcome measures. For example, in creating a homelessness measure, studies reporting days in stable housing during a follow-up period were transformed into days of homelessness by subtracting the published result from the total days in follow-up. When multiple symptom rating measures were available, we selected a measure of positive psychotic symptoms as the best representation of severe mental illness. For one study, we contacted authors to provide supplementary data (16).

TABLE 3. Individual Study Responses, Heterogeneity Findings, and Summary Effects for Hospitalization Outcome Measures by Study Design

Study Design	Measure	Comparison/Pre-Intervention (mean or prevalence)	Assertive Community Treatment/Post-Intervention (mean or prevalence)	Effect Difference	Analysis 95% CI	SE	Weight
Randomized controlled trials[a]							
Clarke et al. (18)	Percentage hospitalized during follow-up	41% (N=20 of 49)	46% (N=52 of 114)	–5%	–21%–12%	0.08	34.27
Lehman et al. (3)	Mean days in hospital (past year)	Mean=66.9 (SD=77.1)	Mean=35.4 (SD=76.3)	41%	9%–73%	0.16	37.20
Korr and Joseph (24)	Difference in days hospitalized (past year)	Mean=–20.97 (SD=96.00)	Mean=–36.21 (SD=72.65)	18%	–22%–58%	0.21	23.65
Shern et al. (25)	Percentage using hospital during follow-up (6 months)	Mean=17.4% (SD=30.9%)	Mean=20.3% (SD=27.5%)	–10%	–40%–20%	0.15	41.66
	Summary effect[b]			10%	–7%–27%	0.09	
Observational studies[c]							
Meisler et al. (27)	Percentage hospitalized (past 2 months)	95% (N=108 of 114)	25% (N=29 of 114)	69%	43%–95%	0.13	N/A

[a] Heterogeneity: χ^2=6.16, df=3, p>0.10.
[b] Fixed effects method used because of statistical homogeneity.
[c] Summary statistic not applicable because of single study.

Data Synthesis

For experimental trials, we compared outcomes of subjects receiving assertive community treatment versus subjects receiving other case management treatments. For observational studies, we compared post-assertive community treatment versus pre-assertive community treatment assessments. In trials with three treatment groups (e.g., assertive community treatment versus two non-assertive community treatment comparison groups), results were aggregated into assertive community treatment and non-assertive community treatment outcomes by calculating a weighted mean and pooled standard deviation from the published data (17–20).

We first calculated study-level raw effect differences with 95% confidence intervals (CIs). For binary outcomes, we calculated risk differences with standard error using methods published by Deeks (21). For continuous outcomes, we used Hedges' adjusted g to calculate standardized mean differences with standard error (21). Effect differences were illustrated on a continuous scale that compared assertive community treatment subjects with comparison subjects. A study-level difference of 0% indicated no difference in outcome between groups. A positive-effect difference indicated the degree to which the assertive community treatment outcome surpassed the comparison outcome and vice versa.

In order to maximize homogeneity for statistical synthesis (22), results were segregated by study type (randomized controlled trials and observational studies) and outcome (homelessness, hospitalization, and psychiatric symptom rating). This resulted in six subgroups for synthesis.

Assuming that the published measures within each subgroup remained different yet linearly equatable, unbiased estimators of pooled effect size and variance for each subgroup were calculated using fixed effects methods (21). The heterogeneity of studies within each subgroup was then assessed using chi square test of the Q statistic (22). When significant intragroup heterogeneity was discovered, we recalculated summary effects using random effects methods as described by DerSimonian and Laird (21, 23). All calculations were performed using Excel 2000 software.

Publication bias is a potential confounder of any meta-analysis. Following methods described by Petitti (22), we assessed the likelihood of publication bias using a funnel plot displaying study-level effect difference versus cohort size. Because precision to a true effect difference increases with cohort size, a "funnel" with a wide base and narrow vertex is expected. When negative studies go unpublished, one corner of the funnel will be missing.

Results

The standardized search identified 52 abstracts for review. Ten studies met inclusion criteria; they were six randomized controlled trials comparing assertive community treatment with standard case management (3, 18–20, 24, 25) and four observational studies comparing pre- and post-assertive community treatment outcomes (17, 26–28). We excluded publications that were reviews or descriptive accounts that did not include an assertive community treatment-based treatment or that did not report the outcomes of interest (29–43). Study characteristics are shown in Table 1. We note a number of potential limitations in the quality of included studies. Among randomized controlled trials, there is evidence of a gender bias in recruitment (3) as well as differential attrition between treatment groups (3, 19). Elsewhere, an intent-to-treat analysis is not documented (18–19). We are unable to assess the presence or impact of systematic bias in the individual studies created by these limitations.

Assertive community treatment subjects experienced significantly greater success in reducing homelessness in eight out of 10 studies and four out of six randomized trials (Table 2). The summary effect across randomized trials was 37% (95% CI=18%–55%, Z=3.85, p=0.0001), signifying that assertive community treatment subjects, on average, experienced a 37% greater reduction in homelessness compared with standard case management subjects. Across observational studies, subjects averaged more substantial improvement ([104%] 95% CI=67%–141%, Z=5.50, p<0.0001) when compared with baseline housing levels.

TABLE 4. Individual Study Responses, Heterogeneity Results, and Summary Effects for Psychiatric Symptom Rating Outcome Measures by Study Design

Study Design	Measure	Comparison/Pre-Intervention (mean or prevalence)	Assertive Community Treatment/Post-Intervention (mean or prevalence)	Effect Difference	Analysis		
					95% CI	SE	Weight
Randomized controlled trials[a]							
Morse et al. (19)	Change in mean Brief Psychiatric Rating Scale thought disorder score	Mean=−0.84 (SD=6.26)	Mean=−3.14 (SD=6.15)	37%	4%–70%	0.17	36.11
Morse et al. (20)	Change in mean Global Severity Index score	Mean=−0.69 (SD=0.72)	Mean=−0.64 (SD=0.76)	−7%	−39%–25%	0.16	36.79
Shern et al. (25)	Change in Colorado Symptom Inventory score	Mean=0.04 (SD=0.72)	Mean=−0.28 (SD=0.69)	45%	14%–76%	0.16	40.66
	Summary effect[b]			26%	7%–44%	0.09	
Observational studies[c]							
Lam and Rosenheck (17)	Mean psychotic symptom score, Psychiatric Epidemiology Research Instrument	Mean=11.35 (SD=9.32)	Mean=7.9 (SD=8.57)	38%	34%–42%	0.02	3.74
Morris and Warnock (26)	Mean score, Scale for Assessment of Positive Symptoms	Mean=19.38 (SD=23.25)	Mean=15.64 (SD=20.60)	17%	−39%–73%	0.28	2.88
Wasylenki et al. (28)	Total score, Brief Psychiatric Rating Scale	Mean=40.1 (SD=14.0)	Mean=25.2 (SD=7.8)	131%	91%–171%	0.20	3.25
	Summary effect[d]			62%	0%–124%	0.32	

[a] Heterogeneity: χ^2=5.91, df=2, p>0.05.
[b] Fixed effects method used because of statistical homogeneity.
[c] Heterogeneity: χ^2=21.29, df=2, p<0.001.
[d] Random effects method used because of statistical heterogeneity.

On average, assertive community treatment subjects had better hospitalization outcomes; however, this was statistically significant in only one of four randomized trials (Table 3). The summary effect across randomized trials revealed no significant difference in hospitalization between assertive community treatment and standard case management ([10%] 95% CI= -7%–27%, Z=1.17, p=0.24). A single observational study demonstrated better hospitalization outcomes after assertive community treatment ([69%] 95% CI= 60%–78%, Z=5.21, p<0.0001).

Assertive community treatment subjects had significant reductions in psychiatric symptom severity beyond that experienced by comparison subjects (Table 4). Study-level effect differences were significant in four out of six studies, including two out of three randomized controlled trials. When combined, assertive community treatment subjects averaged a 26% (95% CI=7%–44%, Z=2.76, p=0.006) further symptom improvement in randomized trials and a borderline significant 62% (95% CI=0%–124%, Z=1.96, p=0.05) greater symptom improvement in observational studies.

Data for the analysis of publication bias is shown in Figure 1. We see a narrowing range of study-level effect differences as cohort size increases. Both negative and positive results are reported in the included studies.

Discussion

Relative to standard case management or comparison treatments, assertive community treatment is associated with significant improvements in rates of homelessness and levels of psychiatric symptom severity in the homeless mentally ill. The evidence shows that assertive community treatment was statistically equivalent to standard case management in reducing hospitalization.
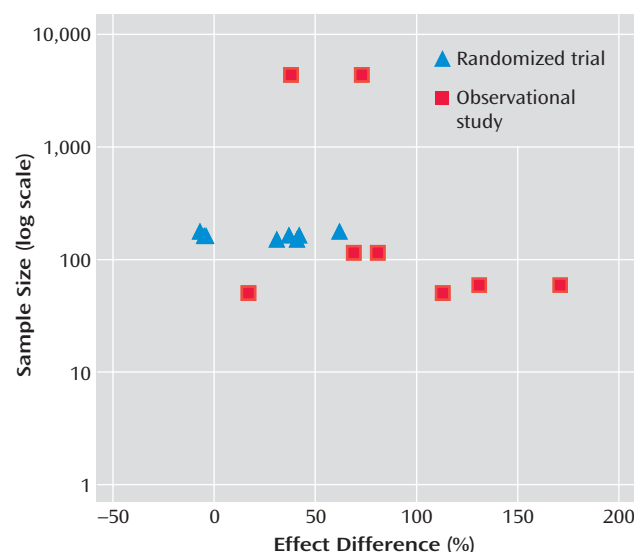
As previously mentioned, prior meta-analyses examined the effectiveness of assertive community treatment versus other case management in severely mentally ill subjects without a specified housing status. These studies showed robust improvement in housing stability for assertive community treatment subjects. It is not surprising that our study, which specifically examines homeless subjects, replicates this significant advantage. It is likely that the key processes of assertive community treatment provide real advantages in engaging the severely mentally ill and providing social supports that correlate with stable housing (44).

The earlier meta-analyses also showed that assertive community treatment led to better hospitalization and symptom severity outcomes for severely mentally ill subjects. In contrast, we found that assertive community treatment led homeless mentally ill subjects toward statistically significant symptom severity reduction but not hospitalization reduction when compared with standard case management.

We believe that the difference in hospitalization findings can be explained by the heterogeneity of the hospitalization measures used in our meta-analysis. As can be seen in Table 3, included studies reporting "days hospitalized" demonstrated more positive findings, while studies reporting "percent hospitalized" demonstrated more negative

FIGURE 1. Assessment of Publication Bias Using a Funnel Plot Comparing Cohort Size Versus Effect Difference

The meta-analysis also has limitations. The cohort of included studies was small. In order to avoid combining dissimilar entities, studies were then segregated by design and outcome, further limiting the power of the meta-analysis. Regarding the symptom severity outcome measure, studies reported a wide variety of instruments, and an assumption was made that these were linearly equatable. Generalizability must also be interpreted with caution. All subjects had a severe mental illness not limited to an addictive disorder, but variation in diagnostic case-mix was not consistently reported across studies.

Despite these limitations, evidence supports our conclusion that assertive community treatment offers significant advantages over standard case management programs in the care of homeless persons with severe mental illness. The use of assertive community treatment leads to greater improvement in housing stability and symptom reduction early in treatment. While hospitalization appears similar in assertive community treatment and standard case management, differences in hospitalization rate and duration require further study. These findings provide support for policy makers and community program directors to institute assertive community treatment as a best available practice to improve outcomes for the homeless mentally ill.

findings. This suggests that assertive community treatment subjects were more likely to be hospitalized but, simultaneously, to spend less time in the hospital than comparison subjects.

Because the homeless mentally ill are a population difficult to engage (45), it is possible that a higher hospitalization rate using assertive community treatment could be considered a success in treatment. Fewer days in the hospital may indicate a benefit of assertive community treatment in facilitating shorter stays or reducing rehospitalization. A "percent hospitalized" measure (18, 25) is not capable of making these distinctions. Their inclusion, therefore, limits the interpretation of our hospitalization outcome. In the future, we recommend the use of "days hospitalized" as a more appropriate measure to assess homeless mentally ill subjects.

Our study is affected initially by the limitations of the included studies (Table 1). Four out of 10 studies were observational and reported greater effect differences. Evidence of impaired randomization or interpolation of missing data could bias in favor of assertive community treatment. In contrast, documentation of low fidelity to assertive community treatment or availability of assertive community treatment to comparison subjects from agencies outside of the study could contribute to a type II error. While each of these limitations may bias the results of an individual study, we do not detect a consistent bias across studies. We conclude that there is a low likelihood of systematic bias in the meta-analysis. Regarding a possible publication bias, our meta-analysis includes smaller studies that exhibit both large and small and positive and negative effect differences (Figure 1). We therefore conclude that there is a low likelihood that publication bias affects the meta-analysis.

CME DISCLOSURE

Dr. Coldwell and Mr. Bender report no competing interests.

APA policy requires disclosure by CME authors of unapproved or investigational use of products discussed in CME programs. Off-label use of medications by individual physicians is permitted and common. Decisions about off-label use can be guided by scientific literature and clinical experience.

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