

# Cost and Cost-effectiveness of Hospital vs Residential Crisis Care for Patients Who Have Serious Mental Illness

Wayne S. Fenton, MD; Jeffrey S. Hoch, PhD; James M. Herrell, PhD, MPH; Loren Mosher, MD; Lisa Dixon, MD, MPH

**Background:** This study evaluates the cost and cost-effectiveness of a residential crisis program compared with treatment received in a general hospital psychiatric unit for patients who have serious mental illness in need of hospital-level care and who are willing to accept voluntary treatment.

**Methods:** Patients in the Montgomery County, Maryland, public mental health system (N=119) willing to accept voluntary acute care were randomized to the psychiatric ward of a general hospital or a residential crisis program. Unit costs and service utilization data were used to estimate episode and 6-month treatment costs from the perspective of government payors. Episodic symptom reduction and days residing in the community over the 6 months after the episode were chosen to represent effectiveness.

**Results:** Mean (SD) acute treatment episode costs was \$3046 (\$2124) in the residential crisis program, 44% lower

than the \$5549 (\$3668) episode cost for the general hospital. Total 6-month treatment costs for patients assigned to the 2 programs were \$19941 (\$19282) and \$25737 (\$21835), respectively. Treatment groups did not differ significantly in symptom improvement or community days achieved. Incremental cost-effectiveness ratios indicate that in most cases, the residential crisis program provides near-equivalent effectiveness for significantly less cost.

**Conclusions:** Residential crisis programs may be a cost-effective approach to providing acute care to patients who have serious mental illness and who are willing to accept voluntary treatment. Where resources are scarce, access to needed acute care might be extended using a mix of hospital, community-based residential crisis, and community support services.

*Arch Gen Psychiatry.* 2002;59:357-364

From the National Institute of Mental Health, Bethesda, Md (Dr Fenton); Department of Epidemiology and Biostatistics and the Department of Family Medicine University of Western Ontario School of Medicine and Dentistry, London (Dr Hoch); Center for Substance Abuse Treatment, Division of Practice and Systems Development, Substance Abuse and Mental Health Services Administration, Rockville, Md (Dr Herrell); Soteria Associates, San Diego, Calif (Dr Mosher); and the University of Maryland, Baltimore (Dr Dixon).

**M**OST PATIENTS with severe mental illness are treated in community settings, where programs charged with caring for them operate under tight fiscal constraints.<sup>1,2</sup> Economic studies of these programs point to acute care episodes involving hospitalization as the single largest cost element in the array of services needed to provide community care.<sup>3-5</sup> In psychiatry, as in the rest of medicine, limiting use of costly inpatient services has been a major strategy for controlling costs.<sup>6,7</sup> Concurrently, limitations in services, including acute care services with very limited lengths of stay, are widely perceived as placing serious burdens on the patients, community mental health systems, and the society that must absorb and manage the consequences of inadequately treated mental illness.<sup>8-10</sup>

Providing acute psychiatric care in specialized treatment homes is one approach to extending the availability and flexibility of crisis care. Residential crisis (RC) services are homes in the community organized to provide acute care for patients who would otherwise be treated in a short-stay psychiatric inpatient unit.<sup>11</sup> Residential crisis programs operate in lieu of a hospital admission for patients with serious mental illness during an illness exacerbation.

Two RC models for patients with serious mental illness have recently been tested. Sledge et al<sup>12</sup> describe a model that used a 4-bed crisis respite apartment combined with day-hospital treatment for acute patients willing to accept voluntary admission. In a randomized trial, RC treatment resulted in outcomes comparable to hospital care.<sup>12</sup> Cost analysis

## SUBJECTS AND METHODS

### SUBJECTS

Methodological details of this study, a randomized trial of RC care for patients enrolled in the Montgomery County, Maryland, Department of Health and Human Services (DHHS), have been described in detail elsewhere.<sup>14</sup> Annually, about 12% of 1600 DHHS patients with severe mental illness experience 1 or more inpatient care episodes; 90% of these hospitalizations are voluntary.

Between July 1, 1992, and December 31, 1994, DHHS outpatients were referred for randomization if they met the following criteria: (1) judged by their clinician to be in need of hospital-level care, (2) judged not to require acute general medical care or detoxification, (3) funded by Medicaid or Medicare, and (4) willing to accept voluntary placement. A computerized randomization sequence maintained at a central location ensured that patients and referring clinicians were blind to treatment assignment at the time of patient referral. Voluntary patients experiencing acute psychosis, depression, suicidality, homicidality, or substance abuse were not excluded from randomization.

A total of 119 subjects (64%) of 185 consecutive referrals screened as eligible and randomized to PH or RC care were studied. Randomized patients not studied declined placement (n=27), withdrew consent for assessment (n=11), did not arrive or were discharged within 24 hours (n=11), or were dropped for administrative reasons (eg, benefits ineligible) (n=17). Unsuccessful placement was more common among PH-assigned (n=42) than RC-assigned (n=24) patients. Patients in the intent-to-treat sample who were screened but not studied did not differ significantly from study patients across 27 prognostic case-mix variables, including days hospitalized in the prior 6 months.<sup>14</sup> Case-mix data also confirmed that patients who received PH (n=50) or RC (n=69) treatment were comparably ill. All patients provided written informed consent for evaluation interviews and medical record reviews.

The average (SD) patient age was 37 (10) years; 62 (52%) were male and 38 (32%) nonwhite. Patients were diagnosed by master's degree-level raters using the Structured Clinical Interview for *DSM III-R*.<sup>16</sup> Frequent diagnoses were schizophrenia (n=33, 28%), schizoaffective disorder (n=31, 26%), bipolar disorder (n=25, 21%), and other mood disorder (n=24, 20%). The *DSM III-R* criteria for co-occurring alcohol or other substance abuse disorder was met by 31 (26%) of 119 patients. Patients were ill an average (SD) of 21 (9) years, had an average of 13 (14) lifetime hospitalizations, and a cumulative average of 43 (70) months of prior hospitalization. In the 6 months preceding admission, 25 subjects (21%) were homeless. Episode length of stay averaged (SD) 19 (14) days for RC care patients and 12 (8) days for PH patients.

### TREATMENT SITES

Patients were randomized to either McAuliffe House (an 8-bed RC program located in a residential neighborhood

in Rockville, Md) or the PH unit of Montgomery General Hospital, Olney, Md. Following discharge, whenever possible, patient readmissions were reassigned to their initial placement facility. Both programs provided acute care to DHHS patients prior to the study; all clinical care was provided as usual within each assigned facility.

The McAuliffe House program model is based on Soteria and Crossing Place<sup>17</sup>, an RC facility operating in Washington, DC, since 1977.<sup>18,19</sup> Two bachelor's degree-level counselors staff the program 24 hours per day under the supervision of a Master's-level program director. Medical responsibility for each patient is maintained by the patient's outpatient psychiatrist who prescribes medications and orders outpatient medical evaluations as indicated. Each newly admitted patient is also evaluated by a consulting psychiatrist who meets with program staff weekly to assist in treatment planning. Beyond a supportive environment, including supervised medication self-administration, one-to-one staff interaction, and group meetings, formal treatment is not provided in the RC facility. Rather, participation in ongoing community treatment, rehabilitation, work, school, or other activities is supported to the extent allowed by the patient's condition. As needed, program staff provide transportation to appointments or activities. Emergency backup for the RC facility is provided by a mobile crisis team. This model strives to provide a small homelike environment that emphasizes continuity with outpatient treatment providers and community networks.<sup>20,21</sup>

Hospital care was provided in a 31-bed Joint Commission on Accreditation of Healthcare Organizations-accredited inpatient psychiatric unit, supported by a day hospital and outpatient clinic. Hospital care included medical assessment, individual psychotherapy, group therapy, and pharmacological management. Hospital physicians attended patients during the acute care episode, and patients were discharged to their referring clinician and/or to other providers as indicated.

### COSTS

Costs were evaluated from the perspective of government as payor for medical treatment and criminal justice costs of publicly subsidized patients who have severe mental illness. Nontreatment-related transfer payments were not included in cost estimates because these costs were not expected to differ by treatment group. The cost estimation strategy involved computing treatment costs for each patient (1) during the acute care treatment episode and (2) for the 6-month period beginning on the first day of the acute care episode. Costs were aggregated within intervention groups to compute mean treatment episode and 6-month costs. All costs were adjusted to fiscal year 1995 dollars. The cost estimations followed this general equation:

Total Costs (TC) = Volume of Service (S)<sub>i</sub> × Unit Cost (UC)<sub>i</sub>, where *i* indexes individual services used.

indicated significantly reduced operating expenses for the RC model, largely attributable to lower overhead costs.<sup>13</sup>

In our randomized trial of an RC model, we found that an 8-bed RC group home that uses community treatment resources rather than a day hospital to provide medical care

## Volume of Service

Consistent with recommendations for economic analyses, a variety of data sources were used to estimate service utilization.<sup>22,23</sup> Client and staff interview data, computerized state Medicaid service claims, and medical record source documents were used as described below.

Treatment episode service use for PH-treated and RC-treated patients includes both bed occupancy and variable (patient-specific) service utilization. During the acute care episode, all services consumed by patients in PH were generated within the hospital program. Hospital billing summaries were used to obtain patient-specific hospital service use, for example, emergency department services, physicians' visits, individual psychotherapy, occupational therapy, laboratory services, medical supplies, radiologic assessments (ie, computed tomographic scan, electroencephalogram, and/or magnetic resonance imaging), electrocardiogram, and medications.

In addition to services intrinsic to the program, patients treated in the RC facility received medical and psychiatric care from clinicians in the community. Residential crisis facility medical records that include documentation of all on-site, off-site, and telephone contacts between patients and their community providers were used to record the volume of community-based services used by each patient during the RC treatment episode (**Table 1**).

To estimate 6-month volume of service, patients were administered a structured interview at index episode admission, at index episode discharge, and at 6-month follow-up. To compare the validity of patient report to service volume estimates derived from other sources, we comprehensively reviewed all Medicaid claims data, client self-report, and medical record source documentation to construct a "gold standard" 6-month service volume estimate for 10% of these patients. Like Lehman et al,<sup>24</sup> we found Maryland Medicaid data grossly underestimated service use for most patients. In contrast, patient self-report correlated highly (mean intraclass correlation coefficient,  $\kappa=0.82$ ) with gold standard volume estimates for 9 medical and psychiatric services: PH or RC psychiatric days, partial hospitalization days, psychosocial rehabilitation days, residential rehabilitation days, psychiatrist visits, other therapist visits, emergency department psychiatric and general medical visits, and ambulance rides. For this reason, patient self-report was used as the primary data source for 6-month service volume estimates. Medical and administrative records were used to estimate medication use, type of crisis, police intervention, and criminal justice service use.

## Unit Costs

Treatment episode costs in each setting includes fixed and variable components. Unit costs for hospital days were developed from cost-based rates established by the Maryland Health Services Cost Review Commission. The Health Services Cost Review Commission uses a Health Care

Financing Administration–like method to generate a facility-specific regulated cost that includes indirect and amortized capital costs.<sup>25</sup> The costs of hospital procedures and professional services were derived from hospital accounting records to reflect the amounts paid for each service unit by government payors.

The RC facility bed cost is based on payments from local government using a cost-based reimbursement method. Unit costs for community-based, fee-for-service treatments used during the RC treatment episode were estimated based on Maryland Title XIX schedules. To estimate nonreimbursed costs to local government, unit costs for community services (eg, physician telephone contacts, treatment team meetings, crisis calls, police intervention, and judicial costs) were based on estimates developed by relevant municipal departments (**Table 1**).

For the 6-month period, total costs include 4 components: (1) cost of index admission; (2) cost of subsequent acute care at a PH or RC center; (3) cost of outpatient treatment services and general medical care; and (4) criminal justice costs (**Table 2**).

## EFFECTIVENESS

Because symptom reduction, restoration of precrisis level of function, and durable return to the community are the major goals of acute psychiatric care, episode symptom reduction and total days living in the community over the 6 months following admission were selected as effectiveness measures. Symptom reduction was measured using the Positive and Negative Syndrome Scale (PANSS)<sup>26</sup> administered at admission, discharge, and 6-month follow-up. Mean reliability achieved by research interviewers for total PANSS score was 0.80 (intraclass correlation coefficient). Administrative and medical records were used to validate patient-reported days living in the community.

## DATA ANALYSES

Mean costs per patient between treatment conditions were compared using 2-tailed *t* tests for individual service categories and total costs. Because cost distributions were skewed, the significance of *t* tests was confirmed with log-transformed data. To examine cost-effectiveness we used incremental cost-effectiveness ratios (ICERs).<sup>24,27-29</sup> Three analyses were conducted: (1) the incremental episode cost per additional PANSS point of episode symptom improvement; (2) the incremental episode cost per additional day residing in the community over the next 6 months; and (3) the incremental 6-month cost per additional day of community residence. Incremental cost-effectiveness ratios were computed by dividing the difference in cost (RC–PH) by the difference in effectiveness. To characterize the uncertainty of the ICER calculations, we used a "bootstrapping" procedure.<sup>30</sup> Each of 5000 bootstrap replications was plotted as a point on the cost-effectiveness plane. The resulting cluster of points reveals the sampling distribution of the ICERs.

and structure also yielded clinical outcomes comparable to hospital care.<sup>14</sup> This model allows patients to maintain continuity of care with their outpatient clinicians across the acute

care episode.<sup>15</sup> In this article we describe the costs and cost-effectiveness of this RC model relative to "usual" care provided in an inpatient unit of a general hospital (PH).

**Table 1. Index Episode Service Utilization and Costs for Patients in Residential Crisis (RC) Care Program\***

Service	Cost/Unit	Volume†	Cost (SD)
RC care			
Fixed			
Bed day	130.87/d	18.74	2452.54 (1798)
Community-provided services			
Psychiatrist	66/h	2.01	131.87 (116)
Psychologist	42.60/h	0.19	8.11 (35)
Social worker	33/h	2.85	94.62 (80)
Bachelor's degree-level therapist	17.40/h	1.16	20.23 (35)
Vocational counselor	16.20/min	0.15	2.35 (9)
Crisis calls	13.83/call	0.23	3.18 (11)
Group therapy	16.49/h	0.41	6.76 (21)
Rehabilitation	57.46/d	1.45	83.31 (183)
Partial hospitalization program	159.60/3 h	0.16	25.54 (93)
Substance abuse therapy	80.86/visit	0.3	24.26 (101)
General medical care	69.16/visit	0.45	31.12 (83)
Ambulance ride	58.52/trip	0.04	2.34 (12)
Medications	3.73/d	18.74	69.99 (51)
Other costs	...	...	90.14 (119)‡
Total costs	...	...	3046.36 (2124)

\*The cost is adjusted to fiscal year 1995 US dollars. Ellipses indicate not applicable.

†Values indicate the mean units of service used by 69 RC care-assigned patients during the index episode.

‡Value includes 6 commitments at \$479 per episode.

## RESULTS

### EPISODE COSTS

The mean (SD) acute care episode cost for 50 PH-treated patients was \$5549 (\$3668) of which \$4167 (\$2893) (77%) were boarding costs; the remainder was expended on hospital professional services, supplies, and procedures. The mean (SD) episode cost for 69 RC-treated patients was \$3046 (\$2124); \$2453 (\$1798) (81%) were boarding costs, while the remainder was expended on community services accessed during the crisis episode (Table 1). The RC services costs averaged \$2403 (45%) less than PH acute care costs ( $t_{72.61} = -4.15$ , effect size = 0.78;  $P < .001$ ).

### SIX-MONTH COSTS

Six-month costs were calculated for 109 (92%) of the 119 randomized patients on whom follow-up data were collected. Mean 6-month costs for patients randomized to PH and RC facilities were \$25737 (\$21835) and \$19941 (\$19282), respectively. Mean 6-month costs for RC-treated patients were \$5796 or 23% less than PH-treated patients; this difference was statistically significant for log-transformed but not untransformed data ( $t_{107} = -1.47$ , effect size = 0.28;  $P = .15$ ). Residential crisis-treated patients' total 6-month hospital costs were reduced by 50% compared with PH-treated patients (\$9107 vs \$1816.10;  $t_{107} = -2.42$ , effect size = 0.51;  $P = .02$ ). Patient groups did not differ significantly in the 6-month costs for any outpatient or community services (Table 2).

### EFFECTIVENESS

Mean (SD) PANSS scores for RC-treated patients were 87 (24) points at admission and 72 (27) points at dis-

charge and for PH-treated patients 89 (25) points at admission and 69 (16) points at discharge. Repeated measures (analysis of variance) indicated a statistically significant time effect ( $F_{2,220} = 52.94$ ,  $P < .001$ ) but no significant treatment site ( $F_{1,110} = 0.23$ ,  $P = .64$ ) or treatment site  $\times$  time interaction ( $F_{2,220} = 1.18$ ,  $P = .31$ ). Episodic symptom improvement averaged 14 (18) PANSS points for RC-treated patients and 20 (16) PANSS points for PH-treated patients. Mean 6-month community days for PH- and RC-treated patients were 142 (45) and 137 (46), respectively ( $t_{117} = 0.64$ , effect size = 0.05;  $P = .50$ ).

### COST-EFFECTIVENESS

Although compared with usual care, the RC intervention was less expensive for both the episode and 6-month follow-up over the treatment episode, the intervention was associated with a reduction of 6 fewer PANSS points and over 6 months, 5 fewer community days. When a treatment yields less effect at a lower cost, the ICER indicates the cost saved for each unit of effectiveness not achieved.<sup>31</sup> The RC episode ICERs were \$395 saved per PANSS point (-\$2403/-6 points) and \$446 per community day (-\$2403/-5 points); the 6-month ICER was \$1070 per community day (-\$5796/-5 points).

For episode symptom reduction, of the 5000 bootstrap replicates, 3% of the ICER estimates are consistent with RC care costing less and providing greater effectiveness, while 97% are consistent with the program costing less and providing less episode symptom reduction (**Figure 1**). For episode cost and 6-month community days (**Figure 2**), 26% of the ICER estimates are consistent with the RC program costing less and providing more. The remaining 74% correspond to the RC program costing less and providing fewer community days than usual care. Finally, evaluating 6-month cost and community days, 28% of bootstrap replicates corre-

**Table 2. Six-Month Service Utilization and Costs for Patients Treated in Residential Crisis (RC) Care Program and General Hospital (PH) During the Index Episode\***

Service	Cost/Unit	Volume†		Cost (SD)		Effect Size
		RC	PH	RC	PH	
Index admission						
Hospital	433.85/d	...	11.87	...	5546.39 (3655)	...
RC care	151.85/d	19	...	3081.34 (2144)	...	...
Subsequent acute care						
Hospital‡						
RC care assigned	423.59/d	20.13	27.94	9106.67 (17 599)	1264.11 (17 637)	0.18
PH assigned	419.27/d					
RC care	151.85/d	6.47	...	1048.92 (2789)	...	...
Outpatient services						
Foster family	102/d	0.24	0.02	26.36 (194)	2.34 (15)	0.01
Detoxification/substance abuse treatment	120/d	0.97	0.6	124.03 (914)	76.92 (490)	0.06
Crisis‡	...	...	...	171.04 (282)	188.60 (308)	0.05
Residential rehabilitation						
RC care assigned	40.46/d	50.2	50.3	2169.64 (4217)	2497.66 (4928)	0.06
PH assigned	46.11/d					
Rehabilitation						
Half day	45/3 h	3.68	1.15	176.86 (637)	55.72 (258)	0.28
Full day	54/5 h	8.58	7.8	494.83 (1281)	453.55 (1181)	0.03
Psychiatrist	62/visit	5.94	7.22	393.38 (338)	482.29 (359)	0.20
Psychologist	44/visit	1.95	3.09	91.62 (229)	146.49 (266)	0.21
Master's degree-level social worker	34/visit	11.37	11.71	412.90 (403)	428.87 (425)	0.03
Case management	18/visit	2.25	0.99	43.30 (187)	19.18 (70)	0.15
Group therapy	16/visit	5.76	6.19	95.36 (140)	103.33 (151)	0.05
General medical						
Inpatient	1079/d	0.35	0.38	408.91 (2879)	444.97 (2521)	0.01
Outpatient	65/visit	2.19	2.04	152.28 (227)	142.97 (188)	0.05
Emergency department	150/visit	0.53	0.55	85.27 (251)	89.35 (197)	0.01
General medical ambulance	55/ride	0.15	0.06	8.52 (43)	3.78 (18)	0.11
Medications	...	...	...	918.43 (302)	962.62 (290)	0.11
Criminal justice						
Arrest	369/event	0.03	...	12.71 (66)	...	0.24
Jail	57/d	0.24	...	14.73 (109)	...	0.17
Total costs	...	...	...	19 941.18 (19 282)	25 737.18 (21 835)	0.28

\*All costs are adjusted to fiscal year 1995 US dollars. Ellipses indicate not applicable.

†Volume indicates the mean volume of service used by 62 RC care-treated patients and 47 PH-treated patients over 6 months.

‡Crisis includes calls, visits, emergency department evaluations, and ambulance services provided.

spond to the RC program costing less and providing more community days than usual care; 64% are consistent with the RC program costing less and providing less, and the remaining 8% are consistent with the program costing more and providing less (**Figure 3**).

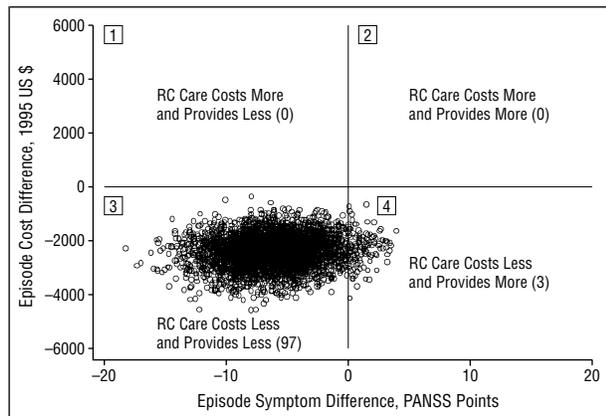
### COMMENT

Because resources to meet the clinical needs of mentally ill persons living in the community are limited, cost and cost-effectiveness analyses assume greater importance in assessing options for provision of service.<sup>3,4,32</sup> In this report we evaluated the cost and cost-effectiveness of RC care for patients with serious mental illness willing to accept voluntary treatment during an illness exacerbation requiring hospitalization. Relative to treatment in a PH, the RC model reduced episode acute care cost by 45%; total 6-month cost by 23%, and total 6-month hospital cost by 50%.

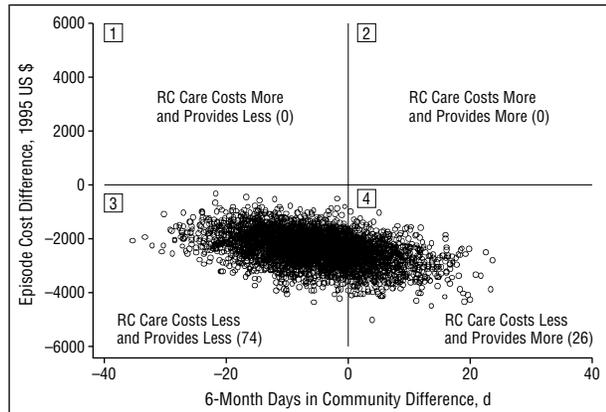
The cost savings achieved by the RC model studied here are similar to those described by Sledge et al<sup>13</sup> who reported a cost of \$501/d for crisis respite/day-hospital

care and \$646/d for hospital care. These data suggest that cost savings can be achieved by providing acute care to voluntary patients in nonhospital settings using either model. Although the use of different cost estimation strategies precludes a direct cost comparison of the 2 models, our use of an 8-bed instead of 4-bed residence, and reliance on community resources rather than a day hospital, likely explains our lower absolute per day treatment costs.

Although our RC model generated large reductions in costs, effectiveness (as measured by episode symptom reduction and total 6-month community days) was nonsignificantly less than PH care. When a technology provides more effectiveness at a lower cost (such as screening for phenylketonuria),<sup>33</sup> it is a dominant choice; likewise, a technology providing less effectiveness at a higher cost can be summarily rejected. When technologies provide more at a higher cost (neonatal intensive care unit, new antipsychotic drugs) or, less at a lower cost, a judgment must be made about whether extra costs or savings are worth the resulting addition or loss in effectiveness.

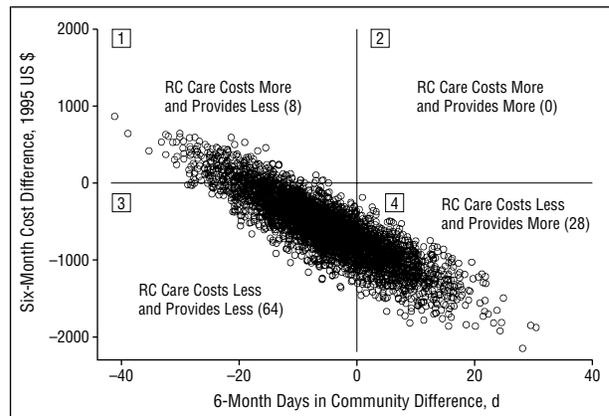


**Figure 1.** The origin on the y-axis represents the difference in mean episode cost (in fiscal year 1995 US dollars) for residential crisis (RC) care— vs hospital-treated patients; the origin on the x-axis represents the difference in mean effect (Positive and Negative Syndrome Scale [PANSS] point reduction) for RC care— vs hospital-treated patients. The axes define 4 quadrants: 1, greater cost, less effect; 2, greater cost, more effect; 3, less cost, less effect; and 4, less cost, more effect. The values are expressed as 5000 bootstrap estimates of episode symptom reduction incremental cost-effectiveness ratios (percentage of the bootstrapped sample).



**Figure 2.** The origin on the y-axis represents the difference in mean episode cost (in fiscal year 1995 dollars) for residential crisis (RC) care— vs hospital-treated patients; the origin on the x-axis represents the difference in mean effect (days in the community over 6 months) for RC care— vs hospital-treated patients. The axes define 4 quadrants: 1, greater cost, less effect; 2, greater cost, more effect; 3, less cost, less effect; and 4, less cost, more effect. The values are expressed as 5000 estimates of episode days in community incremental cost-effectiveness ratios (percentage of the bootstrapped sample).

Is the large cost savings of the RC model worth the observed decrement in outcome? The ICER examines this question from an economic perspective. Our ICER calculation indicates that the more expensive PH model of acute care achieves 6 additional PANSS points of episode symptom reduction at an incremental cost of \$395 per PANSS point. Likewise the hospital achieves each of 6 additional community days over 6 months at an incremental cost of \$1070 per community day. Whether “the cost savings is worth it” depends on the value of other services that might be purchased with these savings. Savings generated by the 6-month cost differential between the RC and PH models would allow purchase of 6-months’ treatment with a new-generation antipsychotic,<sup>34</sup> 6 months of residential rehabilitation service for a patient who had



**Figure 3.** The origin on the y-axis represents the difference in mean 6-month cost (in fiscal year 1995 dollars) for residential crisis (RC) care— vs hospital-treated patients; the origin on the x-axis represents the difference in mean effect (days in the community over 6 months) for RC care— vs hospital-treated patients. The axes define 4 quadrants: 1, greater cost, less effect; 2, greater cost, more effect; 3, less cost, less effect; and 4, less cost, more effect. The values are expressed as 5000 bootstrap estimates of 6-month days in community incremental cost-effectiveness ratios (percentage of the bootstrapped sample).

severe mental illness (Table 2), or 9 months of an apartment for a homeless mentally ill person.<sup>35</sup>

It is also important to evaluate whether the decrement in effectiveness for the RC program has meaningful clinical consequences. While RC-treated patients’ mean PANSS score at discharge was 3 points greater than PH-treated patients, at 6 months no group differences in social functioning, work, acute care days, patient satisfaction, or symptom severity were found.<sup>14</sup> The 6-day difference in community days over 6 months for the RC-treated group was entirely due to a longer index length of stay. Although RC-treated patients maintained participation in community activities, were seen by their community clinicians, and generally had freedom of movement in and out of the facility during the index episode, our analyses did not count days in RC as community days. Using a less conservative “days not hospitalized” over 6 months as an effectiveness measure would yield a 19-day (162 vs 143 days) advantage for the RC model.

These findings must be interpreted in light of this study’s strengths and limitations. This investigation occurred in a mental health system where both service models were operating prior to the study’s inception. Patients were limited to Medicaid and Medicare beneficiaries with multiple hospitalizations over many years. For these reasons, findings should be generalizable to a range of public mental health system patients throughout the United States. At the same time, results are restricted to voluntary patients not requiring detoxification or acute general medical intervention, and generalizability to patients with private third-party insurance is untested.

While the naturalistic setting of this study allowed testing of program model effectiveness, it also imposed limitations. Although we found no difference across 27 case-mix variables between patients randomized to the 2 programs, an unmeasured self-selection bias cannot be ruled out. The necessity of obtaining patient consent may also introduce unmeasured bias.

The economic analyses reported here benefit from our measurement of cost and utilization of a wide range of community services and a high (92%) 6-month retention rate. At the same time, these analyses do not capture all societal costs, but rather measure cost solely from the perspective of government payors. Time costs to patients and families associated with the different care models, for example, remains unexplored and should be considered in evaluating the desirability of disseminating the RC model. Since the focus of this study is the cost differential between 2 acute care programs, however, the costing perspective chosen likely has a scaler effect on results, but should not distort the cost differential between the 2 tested program models.<sup>36</sup> Similarly, while our findings might be limited by the accuracy of our cost estimation procedures (both service volume and cost), this should not differentially affect one or the other treatment setting.

The treatment of patients outside of large long-term institutions is a fundamental value of community psychiatry that creates the need for adequate community-based acute care as part of an optimal mix of acute care, extended care, and residential beds.<sup>8,37</sup> Residential crisis care programs have been implemented in service systems in the United States,<sup>38</sup> United Kingdom,<sup>39</sup> Scandinavia,<sup>40,41</sup> and elsewhere<sup>42</sup> as part of a treatment approach that permits retention in the community and supports continuity of care. From a clinical and policy perspective, the RC model comports with community mental health practice that values the provision of needed care in a least restrictive or most integrated treatment setting.<sup>43,44</sup> Effectiveness data from at least 2 randomized controlled trials<sup>12-14</sup> suggest that where resources are scarce, critically needed acute care might be extended by providing a mix of PH and RC acute care beds.

Replication of RC models in the United States has been limited by the absence of reliable public-funding streams.<sup>11</sup> Based in part on the program model described herein, the State of Maryland recently defined funding (and model governing regulations) for RC care within its public mental health system.<sup>45</sup>

Submitted for publication January 22, 2001; final revision received June 28, 2001; accepted August 13, 2001.

This work was funded in part by grants SM-49102 from the Community Support Program, Center for Mental Health Services, Substance Abuse, and Mental Health Services Administration (Dr Mosher) and R3034A01 from the Natural Sciences and Engineering Council of Canada, Ottawa, Ontario (Dr Hoch).

We gratefully acknowledge the assistance of St Luke's House, Inc (McAuliffe House), Montgomery General Hospital, and the Montgomery (Maryland) County, Maryland DHHS. Dr Fenton acknowledges the professional contributions of Crystal Blyler, PhD, Dexter M. Bullard, Jr, MD, and Pat Schwieterman.

Corresponding author and reprints: Wayne S. Fenton, MD, National Institute of Mental Health, 6001 Executive Blvd, Room 8029, MSC 9669, Bethesda, MD 20892-9619 (e-mail: wfenton@mail.nih.gov).

1. Mechanic D, Rochefort DA. Deinstitutionalization: an appraisal of reform. *Ann Rev Sociol.* 1990;16:301-327.
2. Fenton WS. Community interventions. *Curr Opin Psychiatry.* 2000;13:189-194.
3. Knapp M. Costs of schizophrenia. *Br J Psychiatry.* 1997;171:509-518.
4. Evers SM, Van Wijk AS, Ament AJ. Economic evaluation of mental health interventions: a review. *Health Econ.* 1997;6:161-177.
5. Hollingsworth EJ, Sweeney JK. Mental health expenditures for services for people with severe mental illnesses. *Psychiatr Serv.* 1997;48:485-490.
6. Hodge MA, Davidson L, Griffith EEH, Sledge WH, Howenstine RA. Defining managed care in public sector psychiatry. *Hosp Community Psychiatry.* 1994;45:1085-1089.
7. Mechanic D. Integrating mental health services through reimbursement reform and managed mental health care. *J Health Serv Res Policy.* 1997;2:86-93.
8. Knapp M, Chisholm D, Astin J, Elliot PL, Audini B. The cost consequences of changing the hospital-community balance: the mental health residential care study. *Psychol Med.* 1997;27:681-692.
9. Greenberg DS. Slayings spotlight inadequate mental health services. *Lancet.* 1998;352:463.
10. Dean M. Mental care versus public safety in the UK [editorial]. *Lancet.* 1998;352:1995.
11. Stroul BA. *Crisis Residential Services in a Community Support System.* Rockville, Md: National Institute of Mental Health; 1987.
12. Sledge WH, Tebes J, Rakfeldt J, Davidson L, Lyons L, Druss B. Day hospital/crisis respite care versus inpatient care, 1: clinical outcomes. *Am J Psychiatry.* 1996;153:1065-1073.
13. Sledge WH, Tebes J, Wolff N, Helminiak TW. Day hospital/crisis respite care versus inpatient care, 2: service utilization and costs. *Am J Psychiatry.* 1996;153:1074-1083.
14. Fenton WS, Mosher LR, Herrell JM, Blyler CR. Randomized trial of general hospital and residential alternative care for patients with severe and persistent mental illness. *Am J Psychiatry.* 1998;155:516-522.
15. Fenton WS, Mosher LR. Crisis residential care for patients with serious mental illness. In: Martindale BV, Bateman A, Crowe M, eds. *Psychosis: Psychological Approaches and their Effectiveness.* London, England: Gaskell Press; 2000:157-176.
16. Spitzer RL, Williams JBW, Gibbon M, First MB. *User's Guide for the Structured Clinical Interview for DSM-III-R (SCID).* Washington, DC: American Psychiatric Press; 1990.
17. Mosher LR, Menn AZ. Community residential treatment for schizophrenia: two year follow-up. *Hosp Community Psychiatry.* 1978;39:715-723.
18. Mosher LR, Kresky-Wolff M, Matthews S, Menn AZ. Milieu therapy in the 1980s: a comparison of two residential alternatives to hospitalization. *Bull Menninger Clin.* 1986;50:257-268.
19. Warner R, ed. *Alternatives to the Hospital for Acute Psychiatric Treatment.* Washington, DC: American Psychiatric Press; 1995.
20. Mosher LR, Vallone R, Menn A. The treatment of acute psychosis without neuroleptics: six-week psychopathology outcome data from the Soteria Project. *Int J Soc Psychiatry.* 1995;41:157-173.
21. Kresky-Wolff M, Matthews S, Kalibat F, Mosher LR. Crossing Place: a residential model for crisis intervention. *Hosp Community Psychiatry.* 1984;35:72-74.
22. Rosenheck R, Neale M, Frisman L. Issues in estimating the costs of innovative mental health programs. *Psychiatric Q.* 1995;66:9-31.
23. Clark RE, Teague GB, Ricketts SK, et al. Measuring resource use in economic evaluations: determining the social costs of mental illness. *J Ment Health Adm.* 1994;21:32-41.
24. Lehman AF, Dixon L, Hoch JS, DeForge B, Kernan E, Frank R. Cost-effectiveness of assertive community treatment for homeless persons with severe mental illness. *Br J Psychiatry.* 1999;174:346-352.
25. Ashby J. *A Historical Overview of Hospital Rate Regulation in Maryland.* Lutherville: Maryland Hospital Association and KPMG Peat Marwick; 1994.
26. Kay SR, Opler LA, Fishbein A. *Positive and Negative Syndrome Scale (PANSS) Rating Manual.* Toronto, Ontario: Multihealth Systems Inc; 1992.
27. Gold MR, Siegal JE, Russell LB, Weinstein MC, eds. *Cost-effectiveness in Health and Medicine: Report on the Panel on Cost-Effectiveness in Health and Medicine.* New York, NY: Oxford University Press; 1996.
28. Chaudhary MA, Stearns SC. Estimating confidence intervals for cost-effectiveness ratios: an example from a randomized trial. *Stat Med.* 1996;15:1447-1458.
29. Essock SM, Frisman LK, Covell NH, Hargreaves WA. Cost-effectiveness of clozapine compared with conventional antipsychotic medication for patients in state hospitals. *Arch Gen Psychiatry.* 2000;57:987-994.
30. Mullahy J, Manning WC. Statistical issues in cost-effectiveness analysis. In: Sloan FA, ed. *Valuing Health Care: Cost, Benefits, and Effectiveness of Pharmaceuticals*

- and Other Medical Technologies. Cambridge, England: Cambridge University Press; 1995.
31. Laupacis A, Feeny D, Detsky AS, Tugwell PX. How attractive does a new technology have to be to warrant adoption and utilization? tentative guidelines for using clinical and economic evaluations. *JCMA*. 1992;146:473-481.
  32. Hargreaves WA, Shumway M, Hu T, Cuffel B. Using cost outcome data to guide policy and practice. In: Hargreaves WA, Shumway M, Hu T, Cuffel B, eds. *Cost-Outcome Methods for Mental Health*. San Diego, Calif: Academic Press; 1998: 189-206.
  33. Bush JW, Chen MM, Patrick DL. Health Status Index in cost-effectiveness: analysis of PKU program. In: Berg RL, ed. *Health Status Indexes*. Hospital Research and Education Trust. Chicago, Ill: 1973;172-209.
  34. Rabinowitz J, Lichtenberg P, Kaplan Z. Comparison of cost, dosage and clinical preference for risperidone and olanzapine. *Schizophr Res*. 2000;46:91-96.
  35. Dickey B, Latimer E, Powers K, Gonzalez O, Goldfinger SM. Housing costs for adults who are mentally ill and formerly homeless. *J Ment Health Adm*. 1997; 24:291-305.
  36. Wolff N, Helminiak TW, Tebes JK. Getting the cost right in cost-effectiveness analyses. *Am J Psychiatry*. 1997;154:736-743.
  37. Rothbard AB, Schinnar AP, Hadley TP, Foley KA, Kuno E. Cost comparison of state hospital and community-based care for seriously mentally ill adults. *Am J Psychiatry*. 1998;155:523-529.
  38. Stroul BA. Residential crisis services: a review. *Hosp Community Psychiatry*. 1988; 39:1095-1099.
  39. Boardman AP, Hodgson RE, Lewis M, Allen K. North Staffordshire Community Beds Study: longitudinal evaluation of psychiatric in-patient units attached to community mental health centres, 1: methods, outcome, and patient satisfaction. *Br J Psychiatry*. 1999;175:70-78.
  40. Cullberg J. Integrating intensive psychosocial therapy and low-dose medical treatment in a total material of first episode psychotic patients compared to "treatment as usual": a 3 year follow-up. *Med Arh*. 1999;53:167-170.
  41. Alanen YO. *Schizophrenia: Its Origin and Need-Adapted Treatment*. London, England: Karnac Books; 1997.
  42. Ciompi L, Dauwalder HP, Maier C, et al. The pilot project "Soteria Berne": clinical experiences and results. *Br J Psychiatry*. 1992;(suppl 18):145-153.
  43. Pettila J. Law and psychiatry: The Americans With Disability Act and community-based treatment law. *Psychiatric Serv*. 1999;50:473-474, 480.
  44. Lamb HR. Deinstitutionalization at the beginning of the new millennium. *Harv Rev Psychiatry*. 1998;6:1-10.
  45. Subtitle 21: Mental Hygiene Regulations: 10.21.26 Community Mental Health Programs-Residential Crisis Services. *Maryland Register* 25:1313-1319; July 31, 1998.