The Effects of Independent Living on Persons with Chronic Mental Illness: An Assessment of the Section 8 Certificate Program

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ONE OF THE DISTINCTIVE FEATURES OF THE ROBERT Wood Johnson Foundation Program on Chronic Mental Illness (PCMI) was inclusion of a significant housing intervention alongside the organizational and clinical interventions. The largest component of the housing intervention was 125 Section 8 housing certificates provided by the U.S. Department of Housing and Urban Development (HUD) to each of the nine demonstration sites and specially earmarked for individuals with chronic mental illness (CMI). The Section 8 certificate program is currently the nation's main housing assistance strategy for helping the poor afford a safe and decent place to live. One consequence of the reliance on Section 8 certificates in the PCMI was a strong emphasis on "independent" or "normal" housing, that is, safe, decent, affordable housing located in normal settings, typically in scattered sites, and without on-site services (Newman and Ridgely n.d.; Cohen and Somers 1990). This feature of the demonstration provides a rare opportunity to evaluate the outcomes associated with independent housing, in general, and the feasibility of the Section 8 certificate program for individuals with CMI, in particular.

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The past decade has witnessed growing emphasis on independent housing for individuals with CMI (Carling 1985; Ohio Department of Mental Health 1988; Mandiberg and Telles 1990; New York State Office of Mental Health 1991), but there is limited research on this issue. Much of the mental health literature that addresses housing issues focuses on housing with on-site services, such as sheltered care or board-and-care, rather than on independent apartments in the housing market at large (e.g., Bond et al. 1989; Coulton, Holland, and Fitch 1984; Cournos 1987; Lehman, Slaughter, and Myers 1991; Lipton, Nutt, and Sabatini 1988; Davies et al. 1989). Other studies that examine mental health outcomes of individuals with CMI living "in the community" provide little information about these community settings, making it difficult to judge whether they are, in fact, independent (e.g., Earls and Nelson 1988). Additionally, many of these studies do not control for specific attributes of the housing setting, such as its physical condition, affordability, or presence of neighborhood problems (e.g., Drake, Wallace, and Hoffman 1989). Without such controls, it is impossible to distinguish the effects of a range of potentially relevant factors, such as service utilization, from the effects of housing per se (Newman 1992a). We could find no published studies that both described the extent of independence associated with the setting and conceptually justified the attributes of the housing being examined. Only one published study scrutinized the effects of Section 8 certificates on outcomes for individuals with mental illness (Depp et al. 1986). Although this work was well designed, its usefulness is hampered by very small sample sizes and its sole reliance on housing indicators generated from broad, open-ended questions.

Thus, many questions remain unanswered. The key policy questions continue to be whether independent housing has salutary effects on individuals with mental illness, and what features of independent housing are most important. The research we present in this article, conducted as part of the housing studies component of the National Evaluation of the PCMI, is an initial effort to address these questions.

Hypotheses

The main hypothesis tested in this research is that participation in the Section 8 certificate program is associated with beneficial effects on hospitalizations, residential stability, and service needs. Furthermore, we

theorized that the source of these effects derives directly from the program's provision to recipients of affordable, physically adequate housing in a decent neighborhood and, in the PCMI certificate program, its partial oversight of service gaps.

The conceptual foundation for this hypothesis comes from the work of Earls and Nelson (1988), who build on the motivation-hygiene theory of Herzberg et al. (1974) and Bradburn (1969). According to this theory, long-term psychiatric patients struggle to satisfy "pain-avoidance needs," which range on a continuum from pain to relief. Failure to satisfy these needs results in psychiatric symptoms, which, in turn, negatively affect functioning and increase the probability of hospitalization, the length of stay once hospitalized, and residential instability. Earls and Nelson suggest that "quality of housing" may be one way individuals with CMI can move toward the "relief" end of the continuum, thereby gaining more energy to be devoted to other needs. In the present study, we augment the definition of "quality of housing" to include three dimensions: affordability (i.e., the ratio of housing cost to income is 30 percent or less); physical adequacy; and neighborhood safety and convenience.

Another way in which individuals with CMI may meet their pain-avoidance needs is through fulfillment of their service needs. Accordingly, our second hypothesis is that as the gap narrows between need for and receipt of service, the individual will experience less stress and more positive mental health outcomes. This hypothesis is designed to capture the housing–case manager service linkage component of each site's certificate program. Although meeting tenants' full range of supportive service needs was not part of the Section 8 certificate intervention, program staff in each site attempted to maintain regular contact with tenants and to alert the appropriate service systems if their needs were not being addressed. All participants were provided with the same opportunity for housing–case management services, which means that there is no variation among participants in the sense of some having access to services and others being denied these services.

Methods

The Section 8 Certificate Program

The Section 8 certificate program, formally known as the Section 8 Existing Housing Program, is a nonentitlement housing subsidy program for

income-eligible households. Under this program, HUD provides a subsidy sufficient to reduce the recipient's rental payment to 30 percent of income. Housing units must meet two key criteria before HUD will approve the subsidy. First, the rent must be equal to, or less than, the fair market rent (FMR) established for each housing market area. Second, the housing unit must meet HUD's housing quality standards (HQS). Because the subsidy is tied to the individual and not to a particular housing unit, certificate holders are not required to move to participate in the program. Qualifying in place, however, requires that the applicant's current housing unit meet the FMR and HQS criteria. Whether one moves or not, certificate holders may have to negotiate rents and needed repairs with landlords, and may also have to convince landlords to participate in the program.

The certificate program, like other housing assistance programs, is also subject to HUD site and neighborhood standards. For example, the neighborhood should not be one in which "substandard dwellings or other undesirable elements predominate." The housing should also be accessible to shopping, schools, health and other services and facilities typically found in neighborhoods without assisted housing units.[1]

Study Sites

The National Evaluation collected data on the Section 8 intervention in two of the nine demonstration sites: Baltimore, Maryland, and Hamilton County (Cincinnati), Ohio. Both sites implemented the PCMI certificate program in largely the same way. In each case, a previous employee in the public housing authority's (PHA) Section 8 certificate office was hired by the local mental health authority (LMHA) to direct the PCMI certificate program. The PHA allowed the LMHA to act as the initial point of contact and gatekeeper for Section 8 certificate applications. From the start, it was recognized that independent housing was not the most appropriate option for all persons with CMI. Therefore, case managers were asked to recommend clients who, in their judgment, could benefit from fully independent living. Each site also developed its own application form, which was used to assess the suitability of independent housing for each applicant. Both sites excluded individuals with a pres-

[1] *Code of Federal Regulations*, 24 CFR Ch. VIII, §§ 880.206, 801.206, and 885.730 (1990).

ent pattern of violent or destructive behavior that represented a risk to self or others. Furthermore, only applicants who were "connected" to the mental health system in some manner—attending a day program, working with a case manager, or the like—were considered by the LMHA.

Subjects

Because this was a demonstration of limited size, all qualified applicants could not be served. Program directors at each site reported that those who met the screening criteria were given certificates on a first come–first served basis—the same approach used in the national Section 8 certificate program. Of the 234 applicants in Baltimore, 138 received certificates; of the 794 applicants in Hamilton County, 131 received certificates.

The PCMI certificate program included no provisions for assisting tenants with their service needs. Other than ensuring that all certificate users were connected to the mental health system at the start of their certificate use, neither the Baltimore nor the Hamilton County program gave preferential treatment for services to recipients, such as assigning them priority for new or modified service programs. Both sites, however, designated special "housing case managers" working for the LMHA to maintain regular contact with certificate users through phone calls or personal visits. A primary objective of these contacts was to stay aware of any change in needs—whether in housing, clinical status, or services—and to identify service gaps. Any problems identified were to be referred to the appropriate service agency. The housing case manager, however, was not responsible for ensuring that the service agency responded appropriately, or at all, to the referral.

Data Collection

The primary source of data for this study was a three-year longitudinal survey of the population of PCMI certificate users in each site. The first interview was administered shortly after the individual began to use the certificate. In addition to questions on demographics, socioeconomic characteristics, service utilization, clinical status, and quality of life, respondents were asked detailed questions about their housing status both before and after they began using the Section 8 certificate. Subsequent interviews were conducted on roughly an annual basis. The second and third interviews deleted the segment of questions on housing status prior

to certificate use. In all other respects, however, the survey instruments were essentially identical.

It was not feasible to schedule interviews to coincide precisely with the date that certificate use began. As a result, a substantial proportion of individuals in both sites had already been using their certificates for up to roughly six months at the point of the first interview.

If an individual dropped out of the certificate program, a single close-out interview was conducted. In addition to the full range of measures included in the main survey instrument for this study, the close-out interview asked about the individual's dwelling and neighborhood *during* the period of participation in the certificate program. When individuals dropped out of the program, their certificates were then available for use by another applicant. Because the evaluation took place over a defined three-year period, the study followed these later certificate recipients for shorter periods of time. The baseline universe included 299 individuals in both sites. Response rates for the three survey waves were 77 percent, 94 percent, and 92 percent, respectively.

In addition to the surveys of certificate users, background information was available on all applicants to the PCMI certificate program. These data came from applicant files in each site and include information on demographics, psychiatric diagnosis, and income.

Research Design

Owing to resource constraints, the Section 8 study did not use either an experimental or a comparison group design. This restricted us to a pre-post research design for studying the effects of the PCMI certificate program. Some of the weaknesses generally associated with this design may not be serious problems in this case. The present study does not focus on behaviors that are age related or that coincided with important secular trends (Rossi and Freeman 1989). Although one major event occurred during the study period, namely, the closing of a psychiatric hospital in Hamilton County, this proved to have no appreciable effect on the results. To test for secular trends in affordability, housing, and neighborhood conditions over the period of the demonstration, we examined trends in these indicators for a sample of persons with CMI who did not participate in the Section 8 demonstration (in particular, the community care sample described by Lehman et al. in this issue). Although this group is not strictly comparable to the Section 8 group, we found no evi-

dence that its housing conditions improved; in fact, they appeared to *deteriorate* over the period.

A simple comparison of outcome measures before and after participation in the program would not capture variations in the housing characteristics and service gaps of certificate users, either prior to their participation in the program or after they began to use their certificates. We hypothesized that those who experienced the greatest improvement in housing attributes and service coverage should display the greatest improvement in outcomes. Therefore, we chose a design that relates the degree of improvement in the various dimensions of the PCMI certificate program to the degree of improvement in outcomes. Specifically, outcome measures and the variables that describe the key features of the PCMI certificate program, which we label "program variables," are expressed as change scores. Each outcome measure is regressed on the program variables and on a set of control variables. The change scores measure the difference between the period after the individual began to use the certificate (referred to as "postcertificate") and the period before certificate use began (referred to as "precertificate"). The regressions take the form,

$$\Delta Y = \beta_0 + \Sigma_i \beta_i \Delta P_i + \Sigma_j \beta_j Z_j + \epsilon,$$

where the βs are regression coefficients, ΔY is the change in the outcome measure between the post- and precertificate periods, ΔP is the change in each program variable between the post- and precertificate periods, and Z refers to control variables. These measures are invariant over time.

To assess whether program effects changed with the passage of time, each outcome regression was estimated for two different time periods of Section 8 certificate use: (1) 18 months or less and (2) more than 18 months. To accomplish this, all change score variables were defined for each of these two time periods. Because participants were not interviewed precisely on the anniversary dates of the start of certificate use, the actual time span varies. Therefore, the change score variables for the first time period compare precertificate status to anywhere from 6 to 18 months after participation began; change score variables for the second time period compare precertificate status to anywhere from 19 months to more than three years of participation. For the first time period, the mean duration of use in Baltimore was 9.7 months (s.d. = 4.6) and in Hamilton County, 12.6 months (s.d. = 4.5). For the second time period, the mean duration in Baltimore was 30.7 months (s.d. = 6.67),

and in Hamilton County, 35.1 months (s.d. = 7.1). Individuals who participated in the program for 18 months or less were included in the analysis of the first time period only; those who participated in the program for 18 months or more were included in the analysis for both time periods. To control for variation in the precise time spans covered by these variables, the number of months of certificate use is included in the regression equations as a control variable.

Finally, we estimated the regressions on a data set that pooled the Baltimore and Hamilton County observations, and conducted statistical tests to determine if pooling was justified.

Measures

We rely on four outcome measures in this analysis: average number of days per month spent in the hospital, average number of hospitalizations per month, average number of different residences per month, and the number of service needs reported by the respondent. The first three of these were expressed on a "per month" basis. The fourth outcome variable measures the number of services respondents reported that they needed. The 11 services in this battery of questions include assistance with activities of daily living (such as grooming and bathing), instrumental activities of daily living (such as shopping for groceries and managing money), and help in an emergency or crisis. The interpretation of service needs is not straightforward because it is not clear whether larger numbers of reported needs are an indicator of worse—or better—functioning. The latter would be the case if such reports were tapping the individual's greater awareness of available services, for example. Interpretation of this measure should therefore be approached with caution.

We tested the relationship of each of 10 independent variables to each of these outcomes. To assess program impact, we specified four "program variables" that capture the four key dimensions of the PCMI Section 8 certificate program: (1) affordability, (2) the physical condition of dwelling units, (3) conditions in the neighborhood, and (4) service gaps. The housing and neighborhood variables are similar to those used by HUD in defining its housing quality, site, and neighborhood standards for the national Section 8 certificate program, and consist of counts of housing problems and neighborhood problems, respectively. The indicators themselves are based on survey items that parallel those asked in the

American Housing Survey, the main microdata on the nation's housing, which is collected by the Census Bureau for HUD. (Complete definitions for each variable are given in table 3.) The service-gaps measure, which counts the number of discrepancies between services needed and received, is included as a proxy for the service component of the PCMI certificate program.

These data are limited by our reliance on retrospective reports for some housing measures. In particular, the baseline interview was conducted after the participant had actually begun to use the certificate. Additionally, for dropouts, measures of housing status while participating in the program were, of necessity, collected retrospectively in the final close-out interview. Retrospective reports may be subject to recall bias. In both instances, the time lag typically involved six months or less. Whether this is sufficient for substantial recall bias on questions about housing and neighborhood is unknown.

We include duration of participation in the PCMI certificate program as an independent variable that controls for cross-sectional variation in the time spans over which change score variables are defined. Coefficients on the duration variable may also indicate whether program effects increase or decay over time. Finally, this variable may also control for potential recall bias resulting from delays in the administration of the baseline interview. Because the duration variable serves several functions in the regression models, its interpretation is not straightforward.

We include three indicators of psychiatric status as control variables. Two dichotomous variables—whether the individual's psychiatric diagnosis is depression or bipolar personality disorder, or psychosis or schizophrenia—allow us to account for any differences in outcomes that may be associated with these illnesses, above and beyond other factors. A third variable, the number of psychiatric hospitalizations the individual has experienced since turning 18 years of age, is included as a proxy for severity of illness. It is likely that more recent hospitalizations are more relevant to outcomes than those in the distant past. Unfortunately, data were not available on the timing of hospitalizations that occurred more than one year prior to each interview.

Participation in the PCMI Section 8 program was often synonymous with living alone—in some instances, for the first time in one's life. To the extent that outcomes differ for those whose participation involved a shift from living with others to living alone, a dichotomous variable is included that measures this change in living arrangement. Finally, a

dummy variable indicating whether the certificate user lived in Baltimore or Hamilton County was included to control for site effects.

Specification Issues

Although applicants were ostensibly offered Section 8 certificates on a first come–first served basis, we were concerned that program administrators may actually have exercised some discretion in selecting participants from the pool of applicants. If so, results from the sample of participants may not be generalizable to the population of applicants. In other words, the results may be subject to a form of selection bias.

Using the approach developed by Heckman (1979), we corrected the regressions for this potential source of bias. Using data from the application forms in each site, we estimated a probit equation on the full pool of applicants in which the dependent variable indicated whether or not the applicant received a Section 8 certificate. An index variable, known as the inverse Mills ratio, was constructed from the probit equation and entered into each of the outcome regressions as an additional control variable.

The selection bias correction allows us to generalize the results of the outcome models to the population of likely applicants in these two sites, but not to the larger population of all persons with CMI in the community. No data exist on individuals that case managers decided not to refer. Because we lack data on these nonapplicants, we cannot make inferences about whether the PCMI certificate program would be beneficial for them. Our findings can only be generalized to that portion of the population with CMI who are likely to become applicants to such a program: those who are connected to a mental health system and are not violent or destructive. Although we do not know how large this group is relative to the population of persons with CMI in the community, it is likely that any broad-based implementation of the PCMI certificate program would be similarly targeted to this group.

Another form of selection bias common in longitudinal evaluation studies arises from attrition due to either program dropouts or nonresponse. Attrition bias associated with dropping out does not present a major problem in this case because the number of dropouts was not large and, as already noted, data were collected from dropouts and used in the analysis. Bias from nonresponse also does not appear to pose a problem. Analysis of the characteristics of respondents and nonrespon-

dents for each wave indicated no significant differences across a wide range of attributes including age, race, sex, diagnosis, employment, number of past hospitalizations, and whether the respondent moved in order to receive a certificate.

A final form of selection bias that could affect results is regression to the mean. This would occur if case managers who referred clients to the program selected individuals who were temporarily functioning either better or worse than normal. In this case, it is probably more likely that case managers would refer clients who were functioning at levels higher than would be expected over the long term. If this occurred, regression results would understate program effects.

Aside from selection bias concerns, longitudinal studies often must address problems of simultaneity (or endogeneity). In the present case, because causality may flow in both directions, observations of significant associations between pre–post changes in outcome variables are insufficient to draw causal inferences about the effects of the PCMI certificate program. For instance, although improvements in the physical quality of a person's house that result from participation in the certificate program may have beneficial effects on mental health outcomes, it is also possible that improvements in mental health outcomes that occur because of normal fluctuations in the course of a mental illness may better enable the person to obtain and keep higher-quality housing. To correct for possible bias in regression coefficients arising from this simultaneity, we relied on two-stage least squares estimation. We entered each of the program variables into the outcome equations as an "instrumental" variable (i.e., stripped of endogeneity). These instruments were constructed by regressing each of the four program variables on a set of predetermined (exogenous) variables. These predetermined variables included characteristics of individuals that do not change over time (e.g., sex, race, primary diagnosis), as well as measures of their housing *prior* to their participation in the program (e.g., housing type, living arrangements). The instrumental variables were constructed as the predicted values of these equations, and these predicted values were entered into the outcome equations, along with the other control variables. As a result, the program variables on the right-hand side of the outcome equations are stripped of any possible influence from changes in functioning that occurred after participation in the Section 8 housing program began. One important implication of this approach is that it allows us to interpret the coefficients in the outcome equations as causal relationships.

Results

Selection into the PCMI Certificate Program

Table 1 displays the characteristics of recipients and nonrecipients of PCMI certificates in each site, using the information available from its application forms; the characteristics of recipients and nonrecipients are similar in each site. Further, the differences that exist do not support speculation that the programs selected for the least needy, at least among those who actually applied for a certificate. In Baltimore, for example, more than twice as many recipients as nonrecipients were homeless, temporarily housed, or hospitalized at the point of referral, and half as many were employed either full time or part time. In both sites, recipients also had lower incomes, on average, than nonrecipients. These characteristics constituted the independent variables in the first stage of the Heckman selection bias correction.

Pre- and Postcertificate Housing, Living Arrangements, and Neighborhood

Table 2 summarizes the simple associations between Section 8 participation and housing, living arrangement, and neighborhood attributes. Certificate use was associated with residential moves from group settings or the street to independent residences. One-third of participants in each site moved from group homes, hotels, motels, shelters, or a state of homelessness into their own houses or apartments. The fraction of individuals living in settings with on-site supervision dropped by roughly 80 percent in Baltimore, and to zero in Hamilton County, thereby achieving the goal of independent living emphasized by the PCMI.

Summing all moves together, regardless of origin or destination, indicates that roughly 90 percent of recipients in each site moved to a different dwelling unit. This contrasts with the national Section 8 certificate program in which a large fraction of participants qualify "in place." One recent study indicates, for example, that 30 to 40 percent of recipients remain in their pre–Section 8 dwellings after receiving their certificates (Leger and Kennedy 1990).

Recipients were more likely to live alone after beginning to use their certificates. The proportion of individuals living alone more than tripled

TABLE 1
Characteristics of the Section 8 Applicant Pool: Recipients and Nonrecipients

Characteristics	Baltimore		Hamilton County	
	Recipients (n = 138)	Nonrecipients (n = 96)	Recipients (n = 131)	Nonrecipients (n = 663)
Female	53.5%	53.8%	61.8%	49.7%
Depression or bipolar	43.0%	46.2%	29.3%	25.2%
Psychosis or schizophrenia	50.9%	51.3%	56.1%	54.6%
Connected to mental health services	98.2%	98.7%	91.9%	97.4%
Average age (s.d.)	37 (11)	37 (10)	35 (10)	37 (12)
Average monthly income (s.d.)	$350 ($182)	$408 ($211)	$326 ($148)	$368 ($218)
Substance abuse[a]	26.3%	23.1%	—	—
Suicidal[a]	28.9%	26.9%	—	—
Employed[b]	7.0%	15.4%	—	—
Homeless, temporarily housed, or hospitalized	13.2%	6.4%	—	—
Average lifetime hospitalizations (s.d.)	9 (18)	11 (21)	—	—
African American	—	—	39.8%	41.1%
Married	—	—	0.8%	8.6%
Divorced, separated, widowed	—	—	33.3%	50.5%

[a] Any history, whether recent or not.
[b] Full time or part time.
Sources: Baltimore Mental Health Systems S.8 referral data; Hamilton County Mental Health Board S.8 referral data.

TABLE 2
Pre- and Postcertificate Housing, Living Arrangement, and Neighborhood Attributes

Circumstance	Baltimore (n = 82)		Hamilton County (n = 66)	
	Pre-S.8	Post-S.8[a]	Pre-S.8	Post-S.8
Housing arrangements (%)				
House	59.8	92.7	66.7	100.0
Group home	19.5	6.1	16.7	0.0
Other	20.7	1.2	16.6	0.0
All households	100.0	100.0	100.0	100.0
With on-site staff (%)	29.3	4.9	18.0	0
Homeless (%)	3.7	0	1.5	0
Qualified in place (%)	13.4	—	9.1	—
Living arrangements (%)				
With family	32.9	18.3	33.3	21.2
Alone	22.0	76.8	36.4	77.3
With unrelated persons	45.1	4.9	30.3	1.5
All households	100.0	100.0	100.0	100.0
Lived with others-Pre; alone-post (%)	—	58.5	—	47.0
Housing problems (%)				
Space	48.8	5.2	48.5	6.3
Plumbing	30.5	52.4	31.8	29.2
Interior	25.6	12.2	19.7	15.2
Windows	18.3	13.4	16.7	25.8
Rats	23.2	2.4	10.6	4.5
Heat	20.7	48.1	22.7	72.3
Furniture	20.7	1.5	15.2	0.0
Exterior	22.0	7.5	24.2	9.3
Average housing rating[b]	*6.1*	*8.1*	*5.9*	*7.5*
Neighborhood problems (%)				
Traffic	28.0	45.1	33.3	59.1
Security	20.7	20.8	22.7	18.6
Upkeep	28.0	34.1	30.3	40.9
Crime	48.8	35.8	43.9	42.4
Availability	15.9	11.0	27.3	4.5
Average neighborhood rating	*5.7*	*7.1*	*5.7*	*7.2*

[a] Post-S.8 measures pertain to situation of participants in the program for 18 months or less.
[b] Scale ranges from 1–10, where 1 = worst and 10 = best.

in Baltimore (22 percent to 77 percent), and roughly doubled in Hamilton County (36 percent to 77 percent). Embedded in these aggregate estimates are the nearly 60 percent of individuals in Baltimore, and 47 percent in Hamilton County, who shifted from living with others prior to Section 8 participation to living alone. As we will discuss later, it is plausible that this group would experience the greatest change associated with the program, net of other factors. The most dramatic change in living arrangements was the decrease in the fraction living with unrelated persons, presumably correlated with the enormous impact on residence in group settings.

Comparison of specific housing and neighborhood features pre- and postcertificate also reveals a number of correlations with certificate use. By and large, recipients report sizable improvements in their housing conditions, particularly with respect to space, presence of rats, condition of furnishings, and condition of the exterior of the property. There are notable exceptions, however. Certificate use is associated with either no change in heating or plumbing problems, or an increase in these problems; in Hamilton County, problems with cracked or broken windows worsen. Heating and plumbing problems are endemic to the older housing stock, which may be overrepresented among units meeting the FMR requirements and therefore eligible for certificate use. Despite these problems, however, certificate users rate their postcertificate dwellings substantially higher than their precertificate ones: an increase of two full points on a 10-point rating scale (1 = worst and 10 = best) in Baltimore and 1.6 points in Hamilton County.

The general pattern of large improvements in housing quality associated with the program is not paralleled for neighborhood attributes. Problems with traffic and upkeep increased after participation, and problems with security from break-ins stayed about the same. Although Hamilton County certificate users did not experience much change in the extent to which they viewed crime as a problem in their neighborhood, Baltimore participants were more likely to have experienced a decrease in crime problems after Section 8. The one dimension on which certificate users in both locales experienced significant improvements was the availability of shops, restaurants, and the like.

Taken as a whole, these reports are consistent with the characteristics of older, declining, inner-city neighborhoods. And, in fact, analysis of pre- and postcertificate addresses in the two sites (not presented here) re-

veals a pattern of residential moves inward between the pre and post periods. These are likely to be the locations where the rental stock meets the FMR requirements, and, importantly, where landlords may be more receptive to accepting a Section 8 certificate, in general, and a tenant with CMI, in particular (discussed below). Improvements in access appear to come at the expense of heavier street traffic and noise, as well as problems with upkeep and security. Once again, however, certificate users appear to prefer their postcertificate neighborhoods, rating them roughly 1.5 points higher on a 10-point scale than their previous neighborhoods.

Program Variables

Specific program effects are captured in program variables included in the outcome models. The first four independent variables listed in table 3 present the difference scores between the post- and precertificate periods for each of the four program variables. These means are the predicted values from the program instrument models, which generally parallel the means of the observed data.

Estimates are also provided for the two time periods used in the analysis. Because a higher value on each of these input measures is associated with more problems reported (or, in the case of affordability, a higher housing cost-to-income ratio), we expected a negative sign on the change score if conditions improved as a result of the program.

Results from the first time period indicate that, after Section 8 use began, there was an improvement, on average, in the affordability and physical conditions of housing. In the case of the neighborhood, however, certificate use was associated with increased problems. Given the simple distributions on neighborhood problems just reviewed, this result for the neighborhood problems program variable is not surprising. Service gaps also increased. Although this was not the expected result, the finding is consistent with the absence of a preference for mental health services for recipients of PCMI certificates noted earlier. Because the potential need for the PCMI services intervention greatly exceeded the supply of services, without a rule singling out certificate users for special preference it is not surprising that their service needs were not fully met.

The results for the second time period suggest that the positive effects of the program on affordability and housing problems are sustained, although they are considerably smaller compared with the earlier time period. Increases in utility costs that are not covered by the program sub-

sidy may explain the smaller size of the difference in affordability. It is unclear how to interpret the increase in housing problems. In contrast, neighborhood problems and service gaps decrease over time. Service gaps may have narrowed as mental health services expanded under the larger PCMI demonstration.

Section 8 Outcomes: Regression Results

The first step in this analysis was to correct the regression models for any bias associated with the selection of Section 8 recipients from the pool of applicants. The Heckman selection bias correction indicated that this potential source of bias was not a concern. In every regression equation, the coefficient on the correction index, the inverse Mills ratio, was statistically insignificant and had only a trivial effect on the magnitude of other coefficients in the model. For this reason, and because inclusion of this correction index in a regression biases standard errors, the index variable was dropped from the regressions reported here.

To evaluate whether Baltimore and Hamilton County observations were from the same population, we compared the results from regressions run separately on each site with those run on the two sites pooled together, using an F test. The results indicated that, across all outcome equations and for both time periods, the null hypothesis could not be rejected, suggesting that pooling observations from the two sites was appropriate. We also tested the null hypothesis that the effects of each program instrumental variable on the outcome measures were the same in both sites by including a set of interaction terms between each program variable and the site dummy variable in each outcome regression. None of the coefficients on these interaction terms gained statistical significance, again confirming that pooling the sites was appropriate.

The regression results are shown in table 4. The estimates for certificate use of 18 months or less are given in the left-hand columns, and the estimates for durations of use greater than 18 months are shown in the right-hand columns. Because both the dependent variables and the program variables are measured as changes between the post- and precertificate periods, positive coefficients are consistent with our hypotheses.

Looking first at the shorter duration results, only one program variable is significant in the hospital stay model: neighborhood quality. Its coefficient is negative, however, suggesting that greater neighborhood quality is associated with *longer* hospital stays, not shorter. This finding

TABLE 3
Variable Glossary and Descriptive Statistics for Outcome Models

Variable	Definition	≤18 months mean (s.d.)	>18 months mean (s.d.)
Δ Affordability	Housing cost-to-income ratio post-S.8 − housing cost-to-income ratio pre-S.8[a]	−.10 (.28)	−.02 (.29)
Δ Housing problems	Number of physical housing defects post-S.8 − number of physical housing defects pre-S.8[a,b]	−.51 (2.07)	−.22 (2.02)
Δ Neighborhood problems	Number of neighborhood problems post-S.8 − number of neighborhood problems pre-S.8[a,c]	.14 (1.27)	−.003 (1.47)
Δ Service gaps	Number of services needed and not received post-S.8 − number of services needed and not received pre-S.8[a,d]	1.36 (23.99)	−5.88 (30.94)
S.8 duration	Number of months certificate has been used	11.01 (4.77)	34.82 (6.60)
Lived with others − pre; alone-post	1,0 whether individual lived with others pre-S.8 and lived alone post-S.8	.53 (.50)	.51 (.50)
Depression or bipolar	1,0 whether diagnosis is depression or bipolar disorder[e]	.32 (.47)	.35 (.48)
Psychosis or schizophrenia	1,0 whether diagnosis is psychosis, schizophrenia, or schizoaffective disorder[e]	.57 (.50)	.52 (.50)
No. of adult hospitalizations − pre	Number of hospitalizations since turning 18 pre-S.8	1.18 (2.46)	1.33 (2.90)

1,0 Baltimore	Whether site is Baltimore	.55	(.50)	.54	(.50)
Δ Hospital days per month	Average days hospitalized post-S.8 − average days hospitalized pre-S.8	−.72	(3.07)	−1.25	(3.31)
Δ No. of hospitalizations per month	Average number of hospitalizations post-S.8 − average number of hospitalizations pre-S.8	−.02	(.13)	−.05	(.15)
Δ No. of residences per month	Average number of different residences post-S.8 − average number of different residences pre-S.8	−.17	(.59)[f]	−.42	(.46)[f]
Δ No. of service needs	Average number of services needed post-S.8 − average number of services needed pre-S.8	−.15	(1.71)	−.61	(2.55)

Note: Standard deviation given for analytical variables only.

[a] Predicted value based on regression model.

[b] Respondent reports of at least one problem in each of eight housing features: problems with space or privacy; problems with plumbing; problems with sagging floors or ceilings, or walls that are cracked and crumbled; cracked or broken windows; rats; getting enough heat; and furnishings or building exterior that are rated as "not very good" or "not good at all" (min = 0; max = 8).

[c] Respondent reports of at least one problem in each of five neighborhood features: problems with street noise or heavy traffic; security from break-ins; upkeep and cleanliness of the houses, yards, and streets in the neighborhood; crime in the neighborhood; and the availability or convenience of different services such as restaurants, laundromats, and grocery stores (min = 0; max = 5).

[d] Respondent reports of needing and not receiving assistance with one or more of 11 activities: grooming, bathing, or dressing; taking medicine; housework and laundry; shopping for groceries; cooking or preparing meals; traveling; money management; when feeling upset; resolving problems with other people; a crisis or emergency; leisure time (min = 0; max = 11).

[e] Excluded group includes those with diagnosis of adjustment disorder; alcohol/drug abuse; anxiety disorder; dementia/organic disorder; or personality disorder.

[f] Residential stability data not available for Hamilton County. See text for details.

TABLE 4
Relative Effects of the Section 8 Certificate Program on Individuals with CMI[a,b]

Independent variables	Section 8 duration: ≤18 months				Section 8 duration: >18 months			
	Δ Hospital days per month	Δ No. of hospitalizations per month	Δ No. of residences per month	Δ No. of service needs	Δ Hospital days per month	Δ No. of hospitalizations per month	Δ No. of residences per month	Δ No. of service needs
Intercept	.01	−.01	.54	−.78	1.17	.04	−.09	−2.62
Δ Affordability	1.68	.05	−.34	−.81	1.90*	.04	−.38*	−.23
Δ Housing problems	.10	−.001	.08*	.29**	.13	.01	.09**	.32*
Δ Neighborhood problems	−.52*	−.002	−.14	−.32*	−.54*	−.02	−.09	−.10
Δ Service gaps	−.001	−.0002	.002	.01	.01	.0004	.0008	.01
S.8 duration	−.07	−.003	−.04**	.03	−.12	−.01**	−.001	.04
Lived with others—pre; alone—post	.20	.04	−.06	.03	.54	.06*	−.05	.37
Depression or bipolar	−.40	.01	−.35	.57	1.10	.08*	−.34	.84
Psychosis or schizophrenia	−.64	−.02	−.26	−.29	1.73*	.10*	−.28	.19
No. of adult hospitalizations—pre	.20	.008	.03	−.03	.12	.01	.03	.03
1,0 Baltimore	.86	.01	NA[c]	.70*	.52	−.01	NA	.25
Adjusted R^2	.04	.02	.09	.14	.12	.12	.09	.01
N	147	149	83	149	146	146	79	146

[a] All dependent variables measured as change between post- and precertificate periods (post-pre).
[b] Modest differences in sample composition over the two time periods do not appreciably affect results.
[c] NA = not applicable; model specified for Baltimore only.
* $P \leq .05$ ** $P \leq .01$.

contradicts the first hypothesis, which posits that improved conditions result in improved mental health outcomes. Although initially perplexing, the mental health research literature on housing suggests a possible explanation. A number of empirical studies suggest that communities characterized by low economic status, ethnic and racial diversity, mixed commercial–residential land uses, and moderate levels of "social disorganization" are less rejecting of residents with CMI (Trute and Segal 1976; Segal, Silverman, and Baumohl 1989; Segal and Aviram 1978; Hall, Nelson, and Fowler 1987; Taylor et al. 1984). The simple distributions reviewed earlier on postcertificate neighborhood conditions are consistent with this type of lower-income, diverse, inner-city neighborhood. To the extent that living in a more tolerant and less demanding neighborhood is the important influence on individual outcomes for persons with CMI, the neighborhood program variable used in this analysis may be serving as a proxy for community acceptance.

We could detect no effects for any of the program variables in the model predicting change in number of hospitalizations per month. Although number of hospitalizations has been used as an outcome measure in many studies, it often is not affected by the intervention being examined (e.g., Hodgins, Cyr, and Gaston 1990; Lipton, Nutt, and Sabatini 1988). Other research suggests that the average length of stay may be more amenable to change through housing or services interventions than is hospitalization (Kiesler 1982; Attkisson et al. 1992). Still others disagree about whether even the best intervention can change the natural course of an illness (e.g., Carpenter 1978; Cometa, Morrison, and Ziskoven 1979). One plausible interpretation of this body of work is that the natural course of mental illness for many individuals often requires rehospitalization from time to time. However, if a problem that requires hospitalization can be identified before it becomes a major crisis, the length of stay might be shortened. This interpretation is consistent with the pattern of results observed in this analysis, where the Section 8 intervention appears to affect average length of stay once hospitalized, but shows no effect on number of hospitalizations, at least within the first 18 months of participation.

The results for residential stability pertain to the Baltimore site only because the precertificate residential history was missing for many respondents in Hamilton County. In Baltimore, change in housing problems is positive and significant, suggesting that those whose housing conditions improved made fewer residential moves. For example, a re-

duction in one housing problem between the pre and post periods is associated with about one-tenth fewer residences per month. This result supports the first hypothesis, which states that improved housing conditions are associated with improved outcomes for persons with CMI.

Two program variables are significant in the model predicting change in service needs: housing problems and neighborhood problems. Consistent with our hypothesis, change in housing problems is positive and significant. For example, a reduction in one housing problem between the pre and post periods is associated with nearly one-third fewer service needs per month. However, the effect of neighborhood problems is negative and significant. A plausible interpretation for this result is that the neighborhood variable is tapping the characteristics of a tolerant community.

Beyond 18 months of program participation, there is some evidence that the salutary effects of certificate use increase. In the average hospital days per month model, affordability becomes significant at the .05 level, and the neighborhood problems instrument continues to be significant. After 18 months of participation, more affordable housing is associated with a reduction in the number of days per month spent in the hospital. A 10 percent decline in the ratio of housing costs to income, for example, is associated with a reduction of nearly one-fifth of a day per month in the hospital. This result is consistent with the notion that reduced stress, such as that caused by high housing cost burdens, is associated with positive mental health outcomes. Once again, however, the coefficient on the neighborhood program variable is negative. But if, as noted earlier, this variable is actually tapping the attributes of a tolerant and accepting neighborhood, it becomes less surprising that neighborhoods characterized by some of the problems of economically and socially diverse communities should be associated with positive outcomes for persons with CMI.

Affordability and housing problems are both significant in the Baltimore residential stability model. Although the positive coefficient on the housing problems instrument is predicted by the pain-avoidance theory, the negative coefficient on the affordability program variable is not. This result indicates that less affordable rents are associated with less moving or *greater* residential stability. One possible interpretation is associated with regulations governing the certificate program. These regulations suggest that lower affordability may reflect higher-quality housing, where quality is defined in terms other than those taken into

account in this model. In particular, the primary source of postcertificate housing cost variation is likely to arise from utility costs, which are paid separately from rent and are not covered by the subsidy. These separate utility payments typically occur in buildings that have separate meters for each apartment—something that is more common in newer or rehabilitated structures. Finally, the estimated effect of housing problems on service needs is positive, indicating that a reduction in one housing problem is associated with about one-third fewer service needs per month.

Another way to assess the impact of the PCMI certificate program is to examine the net effects of program participation. The results of this analysis are shown in table 5. The underlying standard for these comparisons is otherwise similar individuals who are not participating in the certificate program and for whom there was no change in housing circumstances and service gaps. The program impact estimates are derived by calculating the mean predicted value from the outcome equations and comparing it with the mean predicted value when the coefficients on the four policy variables and length in the program are set to zero. The estimates indicate that participants, on average, experienced a reduction of about one hospital day per month and, in Baltimore, .46 residences per month during their first 18 months of certificate use. After 18 months of participation, the decline in hospital days per month grows to nearly four and one-half days. Although the number of residences in Baltimore declined by only .05, the fact that some subjects had been using their certificates for as long as three years or more may explain the greater number of moves. In both time periods, reported service needs

TABLE 5
Estimated Impact of the PCMI Section 8 Certificate Program[a]

Dependent variable	≤18 months	>18 months
Δ Hospital days per month	−1.06	−4.43
Δ Number of hospitalizations per month	−.04	−.21
Δ No. of residences per month[b]	−.46	−.05
Δ No. of service needs	+.25	+1.25

[a] Figures represent the net effect of the program as measured by the four program variables and duration of certificate use.
[b] Δ No. of residences model not available for Hamilton County.

increased with participation, and this increase grew with longer durations of certificate use. One possible explanation for this puzzling positive association between duration and needs stems from the pain-avoidance theory discussed earlier. To the extent that participants reach a comfortable, steady state in the program, they may be able to focus more clearly on their needs for assistance. Alternatively, because longer participation in the program may also mean greater exposure to the housing and services system, participants may be more aware of possible types of assistance. A third explanation stems from the nature of mental illness and the fact that, for many CMI persons, functioning and attendant needs for assistance fluctuate over time regardless of programmatic interventions. According to this third explanation, the observed duration effect is picking up the natural course of mental illness rather than anything about the certificate program, per se. Finally, program staff have observed that fully independent living results in some tenants becoming alcohol or drug abusers, or the victims of others who use or sell these substances. Substance abuse can increase assistance needs; when combined with psychotropic medications, alcohol and drugs can worsen a mental illness and can interfere or interact with prescribed medications to cause other health problems (Newman 1992b).

Discussion

The analyses reported here represent an initial effort to examine systematically the mental health effects of independent housing on persons with CMI and, in particular, the effects of Section 8 certificates. The results are not definitive, but they are suggestive. They raise the possibility that providing more affordable and higher-quality housing to persons with CMI can convey benefits above and beyond those associated with the general Section 8 certificate program, primarily lower rent burdens and physically adequate dwellings.

The certificate program appears to have served as a conduit to independent living for its participants. If this view is correct, then the program achieved one of the primary goals of the PCMI housing intervention. Participating in the PCMI certificate program was associated with moving to one's own house or apartment, and virtually all such moves were to settings without on-site supervision in the postcertificate period.

Within the first 18 months in the program, PCMI certificate use was associated with improved housing affordability and generally improved physical dwelling conditions. Improvement in housing conditions had the greatest relative effect on residential instability and service needs. After 18 months of participation, certificate use was associated with improvements in all four program variables: affordability, housing problems, neighborhood problems, and service gaps. Affordability had the greatest relative impact on reducing the number of hospital days per month, whereas improvements in housing quality affected residential stability and service needs.

Neighborhood problems *increased* rather than declined as a result of participation. In some instances, this increase in neighborhood problems is significantly related to *improved* outcomes. The neighborhood variable used in this study may be a proxy for a tolerant community. Undoubtedly, the most important component of an accepting community is the characteristics of its residents—something that this analysis was not able to measure directly. It is reasonable to expect that at least equally beneficial effects would be observed in neighborhoods composed of a socially diverse and accepting population when that neighborhood is also kept up well, does not have heavy traffic or street noise, and has low rates of crime. Our results should not be misinterpreted as support for a relaxation of HUD site and neighborhood standards for certificate users with CMI.

There are also lessons to be learned from the organization and administration of the PCMI certificate program. Significantly, neither the Baltimore nor Hamilton County certificate program appears to have selected for the least needy in selecting certificate applicants. The few existing differences between recipients and nonrecipients suggest that recipients were somewhat more disadvantaged than nonrecipients.

If additional, rigorous research upholds the generally positive findings of this research, then the case would be compelling for improved access of persons with CMI to Section 8 certificates through either the general certificate program or a special set-aside.

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