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RESEARCH ARTICLE

A Randomized Controlled Trial of Intensive Care Management for Disabled Medicaid Beneficiaries with High Health Care Costs

Janice F. Bell, Antoinette Krupski, Jutta M. Joesch, Imara I. West, David C. Atkins, Beverly Court, David Mancuso, and Peter Roy-Byrne

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Objective. To evaluate outcomes of a registered nurse–led care management intervention for disabled Medicaid beneficiaries with high health care costs.

Data Sources/Study Setting. Washington State Department of Social and Health Services Client Outcomes Database, 2008–2011.

Study Design. In a randomized controlled trial with intent-to-treat analysis, outcomes were compared for the intervention ($n = 557$) and control groups ($n = 563$). A quasi-experimental subanalysis compared outcomes for program participants ($n = 251$) and propensity score-matched controls ($n = 251$).

Data Collection/Extraction Methods. Administrative data were linked to describe costs and use of health services, criminal activity, homelessness, and death.

Principal Findings. In the intent-to-treat analysis, the intervention group had higher odds of outpatient mental health service use and higher prescription drug costs than controls in the postperiod. In the subanalysis, participants had fewer unplanned hospital admissions and lower associated costs; higher prescription drug costs; higher odds of long-term care service use; higher drug/alcohol treatment costs; and lower odds of homelessness.

Conclusions. We found no health care cost savings for disabled Medicaid beneficiaries randomized to intensive care management. Among participants, care management may have the potential to increase access to needed care, slow growth in the number and therefore cost of unplanned hospitalizations, and prevent homelessness. These findings apply to start-up care management programs targeted at high-cost, high-risk Medicaid populations.

Key Words. Chronic disease, disability, access, demand, utilization of services, care management

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Disabled Medicaid beneficiaries comprise only 5 percent of the Medicaid population, but they account for over half of all Medicaid spending, primarily due to comorbid chronic physical and mental health conditions, with each condition contributing to their health care costs (Kronick et al. 2000; Kronick, Bella, and Gilmer 2009; Kaiser Commission on Medicaid and the Uninsured 2010). These individuals qualify for Medicaid based on disability after demonstrating that they have an impairment that has prevented them from performing “substantial gainful activity” for at least 1 year and after undergoing a financial asset test to indicate they meet specific income requirements (Decker et al. 2013). Disabled Medicaid beneficiaries typically receive health care in multiple disconnected sites, including emergency departments, hospitals, psychiatric inpatient facilities, community clinics, jails, and substance abuse clinics (New Freedom Commission on Mental Health 2003). Extant literature provides little guidance for providing effective services to disabled beneficiaries; moreover, this group is often excluded from clinical trials due to their complex health conditions, disadvantaged status, and erratic help-seeking (Walkup and Yanos 2005). Consequently, health care providers know least about how to care for patients who need their help most (Walkup and Yanos 2005).

With the advent of the Patient Protection and Affordable Care Act (PPACA), many states will expand Medicaid eligibility to include up to 16 million currently uninsured individuals (Holahan, Kennedy, and Pelletier 2010). There is some evidence that uninsured Medicaid-eligible persons with chronic health conditions may be more in need of care than the current Medicaid-covered population, as the conditions of the former are more likely undetected or uncontrolled prior to becoming insured (Decker et al. 2013). In addition, up to 30 percent of uninsured Medicaid-eligible individuals are estimated to have behavioral health and/or substance abuse disorders; furthermore, those with such disorders are more likely than those without to have one or more chronic physical conditions (Kaiser Commission on Medicaid and the Uninsured 2011).

Address correspondence to Janice F. Bell, Ph.D., M.N., M.P.H., Betty Irene Moore School of Nursing, University of California, Davis, 4610 X Street #4202, Sacramento, CA 95817; e-mail: janice.bell@ucdmc.ucdavis.edu. Antoinette Krupski, Ph.D., Jutta M. Joesch, Ph.D., Imara I. West, M.P.H., David C. Atkins, Ph.D., and Peter Roy-Byrne, M.D., are with the Center for Healthcare Improvement for Addictions, Mental Illness and Medically Vulnerable Populations (CHAMMP), Department of Psychiatry and Behavioral Sciences, University of Washington at Harborview Medical Center, Seattle, WA. Beverly Court, Ph.D., and David Mancuso, Ph.D., are with the Washington State Department of Social and Health Services, Research and Data Analysis Division, Olympia, WA.

The PPACA calls for “health homes” to integrate primary and behavioral health care and to focus on care coordination to provide effective care for new beneficiaries with multiple chronic conditions (Boyd et al. 2010). Care coordination models have shown positive results for patients with depression, anxiety, chronic illness, and for select Medicare populations (Katon et al. 2010; Archer et al. 2012; Brown et al. 2012). However, few published studies have examined outcomes among *high-risk disabled* Medicaid beneficiaries. One exception employed specially trained community health workers in Arkansas to coordinate home and community-based services for Medicaid-eligible adults with physical disabilities, unmet long-term care needs, and high risk for nursing home admission (Felix et al. 2011). Based on a quasi-experimental design, the intervention reduced annual Medicaid spending by 23.8 percent per participant (Felix et al. 2011).

The current study adds to the limited evidence by reporting outcomes of the King County Care Partners (KCCP) Program, a community-based, registered nurse (RN)-led, multidisciplinary care management intervention delivered in King County, Washington, to disabled Medicaid beneficiaries with mental health and/or substance abuse problems who were determined to be at risk for high future health care costs (Lessler, Krupski, and Cristofalo 2011). The KCCP intervention was designed to support beneficiaries in addressing their social and health care needs and to enhance care coordination, communication, and integration of services across safety net providers.

By connecting participants to community-based health services, we predicted improved access to ambulatory medical and behavioral health services for KCCP participants. We expected improved access to these services could result in reduced hospitalizations and associated costs (Felix et al. 2011; Brown et al. 2012). By addressing social needs through behavioral and social services including housing, we expected reduced criminal activity (Garnick et al. 2014) and homelessness (McCormack et al. 2013). While a recent systematic review of the effectiveness of intensive care management for homeless individuals indicates mixed results, improvements in housing have been identified among those with mental illness (de Vet et al. 2013). Finally, because the intervention was embedded in an agency that authorized long-term care home and community services, and the study population was likely to have unmet needs for these services, we also expected the intervention to be associated with increased use of long-term care.

METHODS

Design

The study was a randomized controlled trial (RCT) with intent-to-treat analysis (ITT) comparing outcomes of disabled Medicaid beneficiaries with mental health and/or substance abuse problems and comorbid physical conditions randomized to the KCCP intervention with those of a control group. The control group received Medicaid-covered care-as-usual. The study was reviewed and approved by the Washington State Institutional Review Board.

KCCP Intervention

King County Care Partners participants received intensive care management from a team comprised of three full-time RNs, two social workers (MSWs) with drug/alcohol treatment training, and a bachelor's-level chemical dependency counselor. Each care management team member (a) received 1 year of intensive training in motivational interviewing; (b) attended regular training focused on behaviorally oriented strategies for managing affective disorders commonly encountered among disabled Medicaid beneficiaries (e.g., depression, anxiety); (c) received ongoing clinical supervision by an experienced nurse manager; (d) participated in weekly case-conferences with the KCCP Medical Director; and (e) participated in monthly meetings of community-based organizations providing services to the study population (Lessler, Krupski, and Cristofalo 2011).

All program participants completed a 60–90 minute comprehensive in-person assessment of their medical and social needs with their RN care manager that included time to collaboratively set health-related goals. Subsequently, the care manager arranged to join the participant at one or more clinic appointments, one of which was with the primary care provider. Throughout the program, care management team members provided each participant with chronic disease self-management coaching; frequent in-person and phone monitoring; connection to community resources; and coordination of care across the medical and mental health systems. An in-depth description of the intervention is published elsewhere (Lessler, Krupski, and Cristofalo 2011).

Sample

King County Care Partners eligibility criteria included (a) enrollment in the Medicaid Categorically Needy program; (b) King County, WA, residence; (c) evidence of at least one chronic physical condition and a mental health problem, substance abuse disorder, or both recorded in state administrative databases (e.g., ICD-9-CM codes in Medicaid records, drug/alcohol treatment records; and (d) predicted future health care costs at least 50 percent higher than those of the average Medicaid Supplemental Security Income (SSI) recipient. Predicted future health care costs are based on the Predictive Risk Intelligence System (PRISM) medical cost risk score developed and implemented by Washington State Medicaid programs (Court et al. 2011). PRISM combines diagnostic and pharmacy data to predict future expenditures based on grouping algorithms from two risk adjustment models widely used by State Medicaid programs, the Chronic Illness and Disability Payment System (Kronick et al. 2000) and Rx-Medicaid (Gilmer et al. 2001), both of which have predictive accuracy comparable to commercial alternatives. The PRISM risk score is a ratio calculated by dividing the individual's expected monthly future expenditures by the average monthly future expenditures of all Medicaid SSI recipients. The risk score equals 1.0 if the individual's expected expenditures equal the average expenditures of the group.

In February and March 2009, 1,380 individuals meeting these criteria were randomly assigned to the KCCP intervention ($n = 690$) or wait-list control group ($n = 690$). After randomization, but before the trial began, 133 individuals (19 percent) were excluded from the intervention group and 123 (18 percent) from the control group because they were deemed ineligible for the study due to loss of Medicaid coverage, dual eligibility (i.e., enrollment in Medicaid and Medicare), change of residence, or death. Individuals excluded from the study after randomization were similar in sex and race/ethnicity, older (55 vs. 51 years; $p < .01$), and had higher medical risk scores (2.62 vs. 2.48; $p = .02$). Individuals excluded from the intervention group were older than those excluded from the control group (56 vs. 52 years; $p < .01$), but the distribution of risk scores among those excluded did not differ between the intervention and control groups. The exclusions left 557 individuals randomized to the intervention group and 563 to the control group.

To encourage engagement with the KCCP program among all individuals randomized to the intervention, intensive outreach efforts were employed. These included extensive activities to update addresses, a letter of approach highlighting services provided by the KCCP intervention, and at least three

telephone contact attempts. In 68 percent of cases, these efforts did not yield a response and the case was referred to a Washington State Department of Social and Health Services survey research team with experience recruiting members of high-risk populations and access to a variety of information tools, including Medicaid eligibility, vital statistics, employment history, case worker notes, and prison records (Court 2010).

Data Source

Data were derived from the Washington State Department of Social and Health Services Client Outcomes Database (Kohlenberg 2009), which links (a) Medicaid medical utilization and cost data from the Washington State Health Care Authority (HCA); (b) drug/alcohol treatment records from the state Division of Behavioral Health and Recovery (DBHR); (c) outpatient mental health service utilization and inpatient psychiatric service utilization records from the DBHR and HCA; (d) arrest records from the Washington State Patrol; (e) death records from the Department of Health; and (f) long-term care service utilization and costs from the state Aging and Disability Services Administration.

Outcomes

All outcome measures (Table 1) were available up to 24 months in the postperiod. Because time in the postperiod varied by person (e.g., due to loss of Medicaid eligibility, death, or graduating from the intervention), continuous measures are expressed as average monthly costs or visits.

Statistical Analysis

All analyses were conducted with *Stata, Version 13 MP* (College Station, TX, USA). Sociodemographic characteristics and outcomes of the intervention and control groups in the pre- and postperiod were compared with descriptive statistics. Chi-square tests were used for proportions, *t*-tests for normally distributed continuous variables and Wilcoxon rank-sum tests for skewed distributions. Statistical significance was evaluated at $p < .05$.

Two distinct analyses were conducted. The first (hereafter the RCT analysis) used an intent-to-treat approach to compare outcomes in the pre- and postperiods for all individuals randomized to receive the KCCP intervention ($n = 557$), regardless of participation, to those randomized to the control

Table 1: Study Outcomes

Outcomes	Measure	Variable Definition
Medical costs and service use	Total Medicaid Medical (includes ED services, outpatient medical, inpatient medical admissions, prescription drugs, total long-term care)	Any cost: yes = 1, no = 0 Mean cost per month (\$)
	ED services	Any cost: yes = 1, no = 0 Mean cost per month (\$) Mean total visits per month
	Outpatient Medical (excludes ED services, includes physician services, professional services, lab visits, and fees)	Any cost: yes = 1, no = 0 Mean cost per month (\$) Mean total visits per month
	All Inpatient Medical Admissions	Any cost: yes = 1, n = 0
	Inpatient Hospitalizations with ED visit (unplanned)	Mean cost per month (\$) Mean total admissions per month
	Inpatient Hospitalizations without ED visit	
Long-term care	Prescription Drugs	Any cost: yes = 1, no = 0 Mean cost per month (\$)
	All state ADSA services (including in-home, assisted living, adult family care, adult residential care, nursing home, comprehensive assessment, and miscellaneous services)	Any cost: yes = 1, no = 0 Mean cost per month (\$)
	State ADSA in-home services only	
Mental health services	Outpatient visits from Regional Support Network	Any visit: yes = 1, no = 0 Mean visits per 100 months
	Inpatient admissions in state or community psychiatric hospitals	Any admission: yes = 1, no = 0 Mean cost per month (\$) computed as the sum of community psychiatric inpatient costs plus state hospital costs (assumed at fixed cost of \$509.77/day)
Drug/alcohol treatment services	All drug/alcohol treatment services combined (including residential, outpatient, opiate substitution)	Any cost: yes = 1, no = 0 Mean cost per month (\$)

Continued

Table 1: *Continued*

<i>Outcomes</i>	<i>Measure</i>	<i>Variable Definition</i>
Other outcomes	Criminal arrests (includes all arrests for felony, misdemeanor, or drug/alcohol related)	Any arrest: yes = 1, no = 0 Mean arrests per 1,000 months Any conviction: yes = 1, no = 0 Mean convictions per 1,000 months
	Criminal convictions	
	Homelessness (includes homeless with/without housing, battered spouse shelter, emergency housing shelter)	Any homelessness: yes = 1, no = 0 Mean months homeless per 100 months
Death	Death in postperiod as identified in death records	Death in postperiod: yes = 1, no = 0

ADSA, Aging and Disability Services Administration; ED, Emergency Department.

group ($n = 563$). The date of randomization served as the index date to define the periods before (preperiod) and after (postperiod) the intervention. A maximum of 12 and 24 months of data were available for the pre- and postperiods, respectively. No data were used for months when clients were ineligible for the program due to loss of Medicaid eligibility, dual Medicaid/Medicare status, or death. Controls were offered the intervention after a 1-year waiting period; however, only five individuals had accepted this offer by the end of 24 months. Accordingly, the ITT included study outcomes for up to 24 months for all individuals, with the five individuals who had enrolled in the intervention retained in the control group.

As our ability to detect program-related effects in the ITT was hampered by low program participation, we undertook a second analysis (hereafter the Participant Analysis). This analysis used a quasi-experimental design to assess the impact of the KCCP intervention for active intervention participants ($n = 251$) versus a propensity score-matched comparison group ($n = 251$). The original randomized control group served as the pool from which the propensity score-matched comparison group was drawn. Comparison group members were selected using a 1 : 1 nearest neighbor propensity score match implemented with `matchit.R` (<http://cran.r-project.org/web/packages/MatchIt/index.html>) using age, gender, race/ethnicity and the following preperiod measures: total Medicaid eligible months, total Medicaid medical costs, inpatient medical costs, long-term care costs, medical risk score (Court et al. 2011), an indicator of drug/alcohol treatment need (Sears et al. 2010), an indicator of drug/alcohol treatment receipt, an indicator of serious mental

illness, state psychiatric hospital days, number of drug/alcohol-related arrests, total arrests, and months of homelessness. Comparisons in Table 2 indicate these measures were balanced after matching.

Due to delays in program implementation, we opted not to use the date of randomization as the index date for the participant analysis. Instead, to fully capture the time during which the participants were exposed to the intervention, the index date for the participant analysis was defined as the date of the first care plan goal, which signifies the beginning of the participant's collaboration with the nurse care manager. Again, no data were used for months when individuals were ineligible to participate.

In both analyses, differences in the outcomes were calculated from the preperiod to the postperiod (i.e., post- minus preperiod), with positive values indicating an increase in the outcome over time and negative values indicating a decrease. Difference-in-differences (D-I-D) regression models were estimated for each outcome including as regressors time (preperiod = 0, postperiod = 1), group (KCCP = 1, control = 0), and the interaction of time by group. The time by group interaction, or D-I-D estimate, is interpreted as the amount of change in the post- versus preperiod for the intervention versus comparison groups. For continuous outcome measures, D-I-D models were estimated with ordinary least squares regression (OLS) using data from all individuals, including those incurring zero costs or visits, as this modeling strategy is generally robust to violations of normality in a sample size comparable to ours (Lumley et al. 2002). Some continuous outcome measures were, however, not normally distributed as indicated by skewness, high kurtosis, and histograms and some had large proportions of observations with no use or outliers with intensive use. We, therefore, implemented alternative modeling strategies (generalized linear models, two-part models, tobit regression) appropriate for nonnormally distributed continuous variables and negative binomial regression for utilization outcomes (using postperiod months as the exposure variable). With rare exceptions, noted in the results section, the findings were qualitatively similar (not shown in tables) to those obtained with OLS. D-I-D models for binary outcome measures were estimated with logistic regression. All models were adjusted for age (in years), race/ethnicity, sex, baseline risk score (Court et al. 2011), an indicator of serious mental illness (defined as having a diagnosis of any psychotic, mania or bipolar disorders, or use of antipsychotic or antimanic medication in the preperiod), and an indicator of need for drug/alcohol treatment in the preperiod as described above (Sears et al. 2010).

Table 2: Covariate Balance before and after Propensity Score Matching and Program Participation Measures

	Participant Group		Before Matching		After Matching	
	n = 251	Control Group		Comparison Group		
		n = 563	p1	n = 251	p2	
Preperiod measures						
Age, mean years (SD)	50 (9)	51 (10)	.26	50 (10)	.52	
Male, %	42	46	.27	42	1.00	
Race/ethnicity, %						
White, non-Hispanic	52	58	.71	53	.95	
Black, non-Hispanic	30	27	—	30	—	
Other	18	16	—	17	—	
Mean risk score (SD) range	2.5 (1.4)	2.5 (1.3)	.94	2.4 (1.0)	.48	
Serious mental illness at baseline, %	49	50	.74	47	.66	
Need for drug/alcohol treatment, %	43	49	.11	44	.79	
Receipt of drug/alcohol treatment, %	22	23	.36	21	.75	
Mean months of Medicaid eligibility (SD)	12 (1)	12 (1)	.89	12 (1)	.73	
Mean Medicaid medical costs per month (SD), \$	1,818 (2,093)	1,861 (2,568)	.90	1,864 (2,672)	.85	
Mean long-term care costs per month (SD), \$	573 (1,276)	518 (1,191)	.02	535 (964)	.12	
Mean inpatient medical costs per month (SD), \$	713 (2,216)	843 (2,153)	.56	652 (1,402)	.22	
Mean state psychiatric hospital days per month (SD)	0.04 (0.45)	0.07 (1.05)	.68	0.07 (0.67)	.64	
Mean drug/alcohol arrests per 1,000 months (SD)	0.99 (9.0)	5.8 (36.3)	.06	1.7 (15.7)	.99	
Mean criminal arrests per 1,000 months (SD)	8 (34)	22 (94)	.04	8 (31)	.72	
Mean homeless months per 100 months (SD)	7 (23)	13 (33)	.01	8 (24)	.85	
Program participation measures						
Mean months to health goal from randomization (SD) range	7 (4) 0–16	—	—	—	—	
Mean total contacts (SD) range	80 (59) 9–404	—	—	—	—	
Direct contacts (SD) range	31 (28) 1–191	—	—	—	—	
Collateral contacts (SD) range	49 (33) 5–213	—	—	—	—	

Two observations were used per individual: one for the preperiod and one for the postperiod. Robust standard errors were estimated to account for the resulting nonindependence of observations. All models were estimated with and without the number of postperiod months of available data used as sampling weights. The weighted estimates may better account for the known high variability in costs and use in the study population by placing higher weight on outcomes based on more months of available data. The unweighted estimates may address any bias associated with attrition that might be introduced by these weights. The weighted estimates are presented in the tables and any differences in magnitude or significance of the findings across these two modeling strategies are discussed in the text.

RESULTS

RCT Analysis

The intervention and control groups were similar at baseline with respect to sex, age, racial/ethnic composition, and medical risk (Table 3). The average age was 51 years; nearly half were male and approximately 57 percent were white, non-Hispanic. Approximately half in each group had a serious mental illness. The proportion with drug/alcohol treatment need and the mean months eligible for Medicaid in the pre- and postperiods were also similar in both groups.

The difference-in-differences estimates did not differ significantly for most outcomes (Table 4). Exceptions included higher monthly prescription drug costs by \$74; 30 percent greater odds of outpatient mental health visits ($p < .01$); and 95 percent higher odds of criminal conviction ($p = .02$) in the intervention group. In addition, the negative binomial model results indicated the intervention group had a higher rate of inpatient admissions without an ED visit than controls (IRR: 1.62; 95 percent CI: 1.03, 2.56; $p = .04$), while this association was not significant in the linear regression model.

KCCP Participant Characteristics

Of those offered the intervention ($n = 557$), 45 percent ($n = 251$) set at least one health-related goal in collaboration with their care manager. Participants did not differ from nonparticipants ($n = 306$) on age, race/ethnicity, risk score, preperiod Medicaid eligible months, preperiod homeless months, or postperiod death (Table 3; Participants vs. Nonparticipants). However, fewer

Table 3: Preperiod Sample Characteristics

	Randomized Controlled Trial Analysis		Program Participation Analysis		Nonparticipants in Intervention Group (vs. Participant Group)	
	Intervention Group n = 557	Control Group n = 563	Participant Group n = 251	Comparison Group n = 251	n = 306	p
Demographics						
Age, mean years (SD)	51 (11)	51 (10)	50 (9)	50 (10)	51 (12)	.48
range	22–85	21–84	22–83	21–84	22–85	
Male, %	48	46	42	42	52	.02
Race/ethnicity, %						
White, non-Hispanic	57	58	52	53	61	.22
Black, non-Hispanic	26	27	30	30	22	–
Other	17	16	18	17	17	–
Risk profile						
Mean risk score at baseline (SD)	2.5 (1.3)	2.5 (1.3)	2.5 (1.4)	2.4 (1.0)	2.5 (1.3)	.66
range	1.5–15.8	1.5–16.1	1.5–15.8	1.5–10.4	1.5–9.7	
Serious mental illness at baseline, %	49	50	49	47	50	.87
Need for drug/alcohol treatment at baseline, %	44	49	43	44	46	.44
Medicaid eligibility						
<12 months in the preperiod, %	8	9	6	8	9	.24
Mean months preperiod (SD)	12 (1)	12 (1)	12 (1)	12 (1)	12 (1)	.79
range	5–12	5–12	7–12	6–12	5–12	
Mean months postperiod (SD)	20 (7)	20 (7)	17 (6)	16 (6)	18 (8)	<.01
range	1–24	1–24	1–24	1–24	1–24	
Outcomes						

Continued

Table 3: *Continued*

	Randomized Controlled Trial Analysis		Program Participation Analysis		Nonparticipants in Intervention Group (vs. Participant Group)	
	Intervention Group <i>n</i> = 557	Control Group <i>n</i> = 563	<i>p</i>	Participant Group <i>n</i> = 257	Comparison Group <i>n</i> = 251	<i>p</i>
Total Medicaid medical						
Any, %	100	100	—	100	100	—
Mean cost per month (SD), \$	1,948 (2,296)	1,861 (2,568)	.54	1,818 (2,093)	1,864 (2,672)	.85
Emergency room						
Any, %	71	71	.96	65	70	.18
Mean cost per month (SD), \$	125 (247)	104 (179)	.97	107 (251)	100 (184)	.32
Mean visits per 100 months (SD), <i>n</i>	34 (70)	31 (51)	.87	31 (77)	27 (44)	.53
Outpatient medical						
Any, %	100	100	1.00	100	99	.16
Mean total cost per month (SD), \$	389 (576)	359 (492)	.42	420 (751)	419 (614)	.73
Mean visits per month, <i>n</i>	4.6 (4.0)	4.4 (3.8)	.37	4.5 (3.6)	4.6 (4.1)	.76
Inpatient medical admissions						
Any, %	42	39	.24	37	32	.22
Mean cost per month (SD), \$	780 (1,750)	843 (2,153)	.33	652 (1,402)	713 (2,216)	.22
Mean admits per 100 months (SD), <i>n</i>	7.3 (12.4)	7.5 (15.6)	.30	6.4 (11.8)	5.9 (14.3)	.70
Any w/o ED visit, %	13	17	.13	13	15	.52
Mean cost per month w/o ED (SD), \$	195 (844)	290 (1,077)	.10	189 (698)	206 (748)	.58
Mean admits w/o ED per 100 months (SD), <i>n</i>	1.5 (4.3)	1.8 (4.5)	.11	1.5 (4.1)	1.5 (3.9)	.58
Any with ED visit, %	35	30	.11	31	23	.04
Mean cost per month w/ED Visit (SD), \$	585 (1,414)	554 (1,626)	.10	463 (1,109)	508 (1,988)	.06
Mean admits w/ED per 100 months (SD), <i>n</i>	5.8 (11.3)	5.7 (13.7)	.14	5.0 (10.3)	4.5 (12.7)	.05
Prescription drugs						
Any, %	100	99	.25	100	100	1.00

Continued

Table 3: Continued

	Randomized Controlled Trial Analysis			Program Participation Analysis			Nonparticipants in Intervention Group (vs. Participant Group)
	Intervention Group n = 557	Control Group n = 563	p	Participant Group n = 251	Comparison Group n = 251	p	
Mean cost per month (SD), \$	492 (630)	438 (446)	.93	512 (633)	493 (457)	.14	463 (631)
Long-term care							
Any, %	32	27	.05	37	28	.04	31
Mean total cost per month (SD), \$	569 (1,147)	518 (1,191)	.08	535 (964)	573 (1,276)	.12	638 (1,298)
Any in-home service, %	22	20	.41	28	21	.08	19
Mean in-home cost (SD), \$	290 (727)	297 (817)	.49	407 (831)	379 (1,026)	.11	246 (697)
Psychiatric inpatient							
Any, %	7	8	.61	6	10	.07	7
Mean cost per month (SD), \$	99 (612)	104 (629)	.87	5 (34)	8 (35)	.45	125 (766)
Mental health outpatient							
Any, %	23	32	<.01	22	26	.25	24
Mean visits per 100 months (SD), n	68 (200)	79 (180)	<.01	58 (143)	68 (151)	.27	78 (237)
Drug/alcohol treatment							
Any, %	23	22	.92	22	21	.75	25
Mean cost per month (SD), \$	54 (135)	63 (186)	.99	52 (133)	47 (130)	.71	59 (144)
Criminal arrests							
Any, %	13	11	.37	7	8	.74	14
Mean per 1,000 months (SD), n	18 (59)	22 (94)	.47	8 (31)	8 (34)	.72	23 (71)
Criminal convictions							
Any, %	8	11	.10	8	8	1.00	9
Mean per 1,000 months (SD), n	17 (72)	26 (103)	.10	11 (39)	10 (45)	.99	20 (75)
Homeless months							
Any, %	17	14	.19	10	11	.89	16
Mean per 100 months (SD), n	11 (30)	13 (33)	.17	7 (23)	8 (24)	.85	12 (33)

Table 4: Randomized Controlled Trial Analysis

	Unadjusted Difference (Pre- to Postperiod)			Adjusted DID	
	Intervention (<i>n</i> = 557)	Control (<i>n</i> = 563)	<i>p</i>	Estimate [95% CI]	<i>p</i>
Total Medicaid medical					
Any, %	—1	—1	.31	OR	.73
Mean cost per month (SD), \$	147 (2,816)	57 (3,194)	.82	\$	51 [—242, 344]
Emergency room					
Any, %	1	2	.74	OR	.82
Mean cost per month (SD), \$	—22 (172)	—10 (156)	.22	\$	0.96 [0.67, 1.38]
Mean visits per 100 months (SD), <i>n</i>	—6 (43)	—5 (40)	.38	<i>n</i>	—8 [—26, 10]
Outpatient medical					
Any, %	—1	—2	.84	OR	.91
Mean cost per month (SD), \$	11 (735)	—15 (528)	.52	\$	—0.3 [—5.0, 4.5]
Mean visits per month, <i>n</i>	0.1 (3.7)	0.1 (3.6)	.60	<i>n</i>	—
Inpatient medical admissions					
Any, %	3	4	.59	OR	.43
Mean cost per month (SD), \$	85 (2,323)	78 (2,868)	.67	\$	—0.11 [—0.51, 0.28]
Mean admits per 100 months (SD), <i>n</i>	0.8 (15.2)	0.2 (15.0)	.91	<i>n</i>	0.92 [0.66, 1.27]
Any w/o ED visit, %	5	1	.17	OR	.92
Mean cost w/o ED visit per month, \$	—13 (1,068)	—92 (1,419)	.07	\$	—12 [—260, 236]
Mean admits w/o ED per 100 months (SD), <i>n</i>	0.1 (6.3)	—0.5 (5.1)	.09	<i>n</i>	0.3 [—1.2, 1.9]
Any with ED visit, %	4	6	.68	OR	1.39 [0.89, 2.16]
Mean cost w/ED visit per month (SD), \$	98 (1,974)	170 (2,243)	.28	\$	73 [—35, 182]
Mean admits w/ED per 100 months (SD), <i>n</i>	0.7 (13.7)	0.7 (13.0)	.35	<i>n</i>	0.5 [—0.1, 1.1]
Prescription drugs					
Any, %	—1	—1	.81	OR	.83
Mean cost per month (SD), \$	33 (670)	—40 (361)	.21	\$	0.96 [0.69, 1.35]
Long-term care					
Any, %	8	6	.24	OR	.42
Mean cost per month (SD), \$	109 (558)	82 (598)	.14	\$	1.09 [0.88, 1.35]
Any in-home service only, %	5	4	.39	OR	.33
					.31

Continued

Table 4: Continued

	Unadjusted Difference (Pre- to Postperiod)			Adjusted DID	
	Intervention (n = 557)	Control (n = 563)	p	Estimate [95% CI]	p
Mean cost in-home only per month (SD), \$	62 (301)	56 (334)	.65	\$ 12 [−28, 52]	.56
Psychiatric inpatient admissions					
Any, %	2	2	1.00	OR 0.84 [0.50, 1.41]	.52
Mean cost per month (SD), \$	−36 (487)	−35 (486)	.81	\$ −13 [−71, 45]	.67
Mental health outpatient					
Any, %	3	−1	.02	OR 1.30 [1.07, 1.58]	<.01
Mean visits per 100 months (SD), n	−16 (165)	−9 (157)	.12	n −5 [−22, 13]	.61
Drug/alcohol treatment					
Any, %	1	2	.43	OR 0.92 [0.65, 1.30]	.62
Mean cost per month (SD), \$	−4 (98)	−18 (161)	.82	\$ 13 [−2, 28]	.10
Criminal arrests					
Any, %	0	3	.22	OR 0.81 [0.52, 1.28]	.38
Mean number per 1,000 months (SD), n	−2 (58)	−4 (95)	.38	n 4.7 [−3.8, 13.2]	.28
Criminal convictions					
Any, %	0	−4	.01	OR 1.95 [1.10, 3.44]	.02
Mean number per 1,000 months (SD), n	−9 (73)	−16 (110)	<.01	n 8.9 [−1.5, 19.3]	.09
Homeless months					
Any, %	−3	−1	.26	OR 0.83 [0.60, 1.17]	.29
Mean number per 100 months (SD), n	−1 (42)	3 (54)	.30	n −1.5 [−4.3, 1.3]	.29
Death					
Any, %	7	8	.68	−	−
aOR [95% CI]*	0.65 [0.39, 1.09]		.10	−	−

Note. All models include indicators of group assignment, time (post = 1; pre = 0), and group × time interaction. All were adjusted for risk score (as a measure of condition severity), age, race/ethnicity, sex, serious mental illness, and alcohol and drug treatment need, and were weighted by the number of months of eligibility during the postperiod. DID estimates were derived from interaction term for time (pre vs. post) × group (treatment vs. comparison) and are interpreted as the difference in the outcome between the groups.

*OR for death adjusted for risk score, age, race/ethnicity, sex, serious mental illness, alcohol and drug treatment need, and weighted by the number of months of eligibility during the postperiod.

w/, with; w/o, without; OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; DID, difference-in-differences.

participants were male (42 percent vs. 52 percent; $p = .02$) and the mean months participants were eligible for Medicaid in the postperiod was greater (20 vs. 18; $p < .01$).

Participant Analysis

Among participants (Table 2), the time from randomization to setting the first care plan goal ranged from 0 to 16 months (mean = 7), suggesting considerable delays. Participants had 19,789 total program contacts with average total contacts shown in Table 2. Approximately, 39 percent ($n = 7,698$) were direct contacts, that is, patient-care manager interactions by telephone/e-mail ($n = 5,665$; 74 percent) or in person ($n = 2,033$; 26 percent; not shown in tables). The remaining 61 percent of contacts ($n = 12,091$) were collateral, for instance, between providers/referral agencies and care manager. Of the direct contacts, 0.61 were in person and 1.54 by telephone/e-mail for an average of 2.15 each month.

In the difference-in-differences regression, participants had, on average, two fewer inpatient medical admissions preceded by an ED visit per 100 months ($p = .02$; Table 5) and associated monthly costs were lower by \$321 relative to the comparison group. The direction of this association in the negative binomial regression also indicated fewer inpatient medical admissions preceded by an ED visit for participants versus the comparison group; however, this finding did not reach statistical significance (0.68; 95 percent CI: 0.40, 1.13; $p = .14$; not shown in tables).

Participants had higher average monthly costs for prescription medications by \$148 relative to the comparison group ($p = .05$). Participants also had greater odds of long-term care costs than the comparison group (OR = 1.36; $p = .04$). Total long-term care costs included the following services: in-home, assisted living, adult family care, adult residential care, nursing home, comprehensive assessment, and miscellaneous. Analyses of the separate components indicated that the increase in long-term care costs was driven by greater odds of in-home support services for participants relative to the comparison group (OR = 1.46; $p = .01$).

Relative to the comparison group, participants had \$15 higher average monthly drug/alcohol treatment costs ($p = .03$) and lower odds of homeless months (OR = 0.45; $p < .01$). Finally, although not statistically significant, the odds of death were 35 percent lower in the participant group relative to the comparison group (4 percent vs. 6 percent; $p = .06$) in models fully adjusted for all covariates. A Cox proportional hazards model (results not shown) indi-

Table 5: Participant Analysis

	Unadjusted Difference (Pre- to Postperiod)			Adjusted DID	
	Participants (n = 251)	Comparison (n = 251)	p	Estimate [95% CI]	p
Total Medicaid medical					
Any, %	0	-1	.16	OR	—
Mean cost per month (SD), \$	136 (2,259)	143 (2,764)	.47	\$ -50 [-472, 371]	.25
Emergency room					
Any, %	4	-3	.13	OR	.45
Mean cost per month (SD), \$	6 (149)	-11 (133)	.49	\$ 9 [-18, 36]	.51
Mean visits per 100 months (SD), n	-1 (38)	-2 (30)	.28	n 1.3 [-4.7, 7.3]	.67
Outpatient medical					
Any, %	0	-1	.25	OR	—
Mean cost per month (SD), \$	20 (638)	-52 (551)	.29	\$ 94 [-19, 206]	.10
Mean visits per month, n	0.1 (3.5)	0.0 (3.4)	.38	n 0.09 [-0.50, 0.69]	.75
Inpatient medical admissions					
Any, %	2	4	.64	OR	.32
Mean cost per month (SD), \$	3 (1,774)	221 (2,367)	.18	\$ -279 [-620, 63]	.11
Mean admits per 100 months (SD), n	0.5 (13.5)	1.1 (12.4)	.19	n -0.02 [-0.04, 0.01]	.09
Any w/o ED visit, %	3	-2	.28	OR	.36
Mean cost w/o ED visit per month, \$	12 (1,074)	-28 (1,124)	.42	\$ 42 [-135, 220]	.64
Mean admits w/o ED per 100 months (SD), n	0.2 (8.2)	-0.4 (4.9)	.27	n 0.3 [-0.6, 1.2]	.48
Any with ED visit, %	1	8	.16	OR	—
Mean cost w/ED visit per month (SD), \$	-8 (1,273)	249 (1,856)	.09	\$ -321 [-591, -52]	.02
Mean admits w/ED per 100 months (SD), n	0.3 (10.0)	1.5 (11.0)	.10	n -2.1 [-3.8, -0.4]	.02
Prescription drugs					
Any, %	0	-1	.16	OR	—
Mean cost per month (SD), \$	107 (957)	-44 (446)	<.01	\$ 148 [1, 296]	.05
Long-term care					
Any, %	8	2	.04	OR	.04
Mean cost per month (SD), \$	103 (545)	36 (502)	.18	\$ 89 [-14, 192]	.09
Any in-home service only, %	10	4	<.01	OR	.01

Continued

Table 5: Continued

	Unadjusted Difference (Pre- to Postperiod)			Adjusted DID	
	Participants (n = 251)	Comparison (n = 251)	p	Estimate [95% CI]	p
Mean cost in-home only per month (SD), \$	46 (280)	5 (325)	.13	\$ 37 [-19, 93]	.20
Psychiatric inpatient admissions					
Any, %	1	-3	.09	OR	.27
Mean cost per month (SD), \$	1 (50)	6 (125)	.29	\$ -2 [-6, 3]	.53
Mental health outpatient					
Any, %	3	-1	.05	OR	.04
Mean visits per 100 months (SD), n	4 (87)	-6 (114)	.13	8 [-9, 25]	.35
Drug/alcohol treatment					
Any, %	-1	-3	.43	OR	.31
Mean cost per month (SD), \$	5 (85)	-12 (77)	.34	\$ 15 [1, 28]	.03
Criminal arrests					
Any, %	1	2	.78	OR	.43
Mean number per 1,000 months (SD), n	1 (29)	0 (39)	.93	0.27 [-6.46, 7.00]	.94
Criminal convictions					
Any, %	-5	-5	.87	OR	.74
Mean number per 1,000 months (SD), n	-8 (41)	-9 (42)	.90	1.6 [-6.0, 9.1]	.69
Homeless months					
Any, %	-3	2	.04	OR	<.01
Mean number per 100 months (SD), n	-3 (13)	-2 (18)	.25	0.45 [0.25, 0.81]	.22
Death					
Any, %	4	6	.31	-	-
aOR [95% CI]*	0.36 [0.13, 1.02]		.06	-	-

Note. All DID models include indicators of group assignment, time (post = 1; pre = 0), and group $\times$ time interaction. All were adjusted for risk score (as a measure of condition severity), age, race/ethnicity, sex, serious mental illness, and alcohol and drug treatment need and were weighted by the number of months of eligibility during the postperiod. DID estimates were derived from interaction term for time (pre vs. post) $\times$ group (treatment vs. comparison) and are interpreted as the difference in the outcome between the groups.

*OR for death adjusted for risk score, age, race/ethnicity, sex, serious mental illness, and alcohol and drug treatment need, and weighted by the number of months of eligibility during the postperiod.
w/, with; w/o, without; OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; DID, difference-in-differences.

cated no difference in time to death between participants and the comparison group.

In the unweighted models (results not shown in tables), the findings for in-home long-term care and prescription drug use were similar in magnitude and significance. However, three other findings had lower magnitude and significance: inpatient costs ($-\$258$; 95 percent CI: $-\$538$, $-\$0.22$; $p = .07$), long-term care use (OR = 1.29; 95 percent CI: 0.98, 1.70; $p = 0.07$), and outpatient mental health service use (OR = 1.28; 95 percent CI: .67, 1.69; $p = .08$).

DISCUSSION

A small proportion of Medicaid beneficiaries accounts for a disproportionately large share of health care costs. The KCCP intervention was built on the premise that integrated behavioral and medical services are essential to address the complex health needs of disabled Medicaid beneficiaries and thereby reduce costs. The intervention led to greater participation in outpatient mental health services and higher average prescription drug costs—findings that suggest increased access and use of needed services. Similarly, the finding from the negative binomial model in the RCT analysis of more inpatient admissions without ED visits in the intervention group relative to controls (results not shown in tables) could reflect more planned hospital stays and improved access to care. While this finding may appear to conflict with results of the D-I-D models in the participant analysis (which indicated fewer inpatient admissions with ED visits), it is possible that both findings indicate improved care coordination and more appropriate service use: more planned hospital admissions in the first instance and fewer unplanned admissions in the second.

At the same time, the study findings provide no evidence of Medicaid cost savings in the target population. In fact, the KCCP group incurred slightly higher average costs for some health services relative to the control group. The lack of cost savings is consistent with results of some of the Medicare Coordinated Care Demonstration Programs (MCCDP), which, despite finding 8–33 percent reductions in hospitalizations among beneficiaries with a high risk of hospitalization, generated no net Medicare savings (Brown et al. 2012).

Results of the MCCDP suggest that program costs need to be kept to about \$125 to \$150 per member per month (PMPM) to generate net savings (Brown et al. 2012). KCCP program costs averaged \$554 PMPM, including

outreach and start-up costs that far exceeded this threshold and would require extremely robust findings for cost offsets to emerge. Without the start-up costs, the program cost approximately \$185 PMPM. Clearly, start-up costs for new program providing intensive care management services can be significant and take time to recoup.

In the quasi-experimental subanalysis designed to detect impacts of the intervention among participants, several outcomes suggested improved access to care, including increased use of prescription drugs, increased use of long-term care services (especially in-home support services), and increased drug/alcohol treatment costs. As monthly estimates, these incremental costs could have impact on short-term overall spending from the payer perspective; at the same time, as measures of improved access to needed services, these costs could pay dividends through slowed deterioration of health status and more appropriate use of other services over the long term.

Results of the participant subanalysis also suggest that growth in costs associated with inpatient hospital admissions preceded by an ED visit may be slowed among participants. Because inpatient admissions that begin in EDs are likely unplanned, it is possible that access to needed care may prevent more costly inpatient services. Although this finding was equivocal in unweighted estimates, the weighted estimate is consistent with recent work finding that high-risk Medicaid recipients with multiple chronic conditions receiving a transitional care intervention were less likely to experience hospital readmission than those with usual care, with greater effects among those at highest risk (Jackson et al. 2013).

Consistent with some studies of intensive care management (de Vet et al. 2013), our results suggest that participation in such programs can provide adequate support to improve housing among disabled Medicaid beneficiaries with high rates of mental health needs. This finding is important as reducing homelessness among individuals with serious mental illness, severe drug/alcohol problems, or chronic illness has the potential for downstream improvements in individual health, health care use, social service use, and related costs—improvements with potential benefits to the wider community. In recent work, for instance, interventions to reduce homelessness in vulnerable populations were associated with reduced inpatient hospital use, emergency department visits, health care costs, justice system services, use of publicly funded services (e.g., jail, shelter and sobering center use, drug/alcohol detoxification and treatment, emergency medical services and Medicaid), and improved quality of life (Larimer et al. 2009; Sadowski et al. 2009; Gilmer et al. 2010; Basu et al. 2012).

Results from earlier intervention studies indicate that cost savings are unlikely to emerge until 3–4 years after program initiation (Unutzer et al. 2008; Katon et al. 2010; Felix et al. 2011). At least one paper suggests it might be unrealistic to expect short-term savings in that the potential for savings lies in more appropriate patterns of care use over time (Kaiser Commission on Medicaid and the Uninsured 2010). Accordingly, the ability to document savings may require that participants are followed at least over a 3–4-year period, a time frame that was not possible in the present study. In fact, the intended 2-year follow-up period in the present study was reduced about 1 year, on average, due to programmatic delays. In addition, while our study is somewhat unique in receiving approval from Centers for Medicare and Medicaid Services (CMS) to include an abeyance group, the eligible disabled Medicaid beneficiaries in the wait-list control group could only be held out for 1 year, per federal requirements, making it impossible to extend the study without a break in randomization. We recommend that future studies of Medicaid populations negotiate with CMS to include abeyance groups for longer wait listing periods to capture cost offsets that may occur up to 4 years after program initiation.

In this study, program participation of 45 percent represents intensive outreach efforts in a high-risk group and is similar to other work employing aggressive outreach in a Medicaid population (Allen et al. 2010). Comparable, or even lower participation rates of approximately 40 percent, are typical in national surveys of Medicaid beneficiaries (Gallagher and Fowler 2004). Should an intervention similar to the KCCP program be offered in the “real world,” participation may be even lower given research-related resources would not be available and the outreach efforts employed in this study would not likely be feasible. While the level of participation achieved represents a three-fold improvement over an earlier pilot study preceding the KCCP program (Court unpublished data), it unfortunately hampers our ability to detect population effects of the intervention. In the future, it will be important to identify more effective recruitment strategies to engage high-cost and high-risk Medicaid beneficiaries in integrated services. In the current study, KCCP Care Managers identified multiple barriers to active participation in the intervention including basic needs for food, shelter, and transportation that took precedence over program participation; depression; not having a phone or being unable to manage a phone due to mental illness or addiction; language or other cultural barriers; and mistrust of the system (Cristofalo et al. unpublished data). As demonstrated in the recent Mental Health Treatment Study (Frey et al. 2008; Drake et al. 2013), incentives that include a rich mix of

services and benefits to meet the basic needs of program participants—including transportation, food, clothing, and counseling—may be required for program engagement among disabled Medicaid beneficiaries.

Several limitations of this study must be considered. First, the KCCP intervention targeted some aspects of the care system but did not address others, such as payment reform or cost containment strategies. Future study of such strategies is recommended. Second, the intervention targeted a high-risk population known to have very high and often variable costs. This inherent cost variability may make it more difficult to detect effects of the intervention. Third, findings from the quasi-experimental analysis may be subject to selection bias. Although supported as a useful method to address selection bias or other threats to randomization, the propensity score approach assumes relevant covariates are captured in the score and no unmeasured confounding (D'Agostino 1998; Posner et al. 2001; Peikes, Moreno, and Orzol 2008). Related, our target population of beneficiaries voluntarily enrolled in the Categorically Needy Aged, Blind, and Disabled Medicaid program also had diagnoses of substance abuse and/or mental illness. Accordingly, the sample included only those with diagnosed mental health or drug/alcohol problems and, by definition, excluded those with undiagnosed or untreated illness. Fourth, our reliance on insurance claims and other administrative data precludes examination of health-related outcomes which could be influenced by the intervention. Similarly, the data available for this analysis did not include access to diagnosis or procedure codes that might be used to differentiate between avoidable versus unavoidable utilization of emergency department visits. Future studies designed to examine a broader set of outcomes including potentially avoidable health care use is warranted. Fifth, findings from the participant analysis may be subject to unmeasured confounding by income, marital status, or social support, which were not available in our data. Sixth, individuals deemed ineligible after randomization were older and had higher risk scores than those included in the analysis sample with older individuals more likely to be excluded from the comparison group. Both variables were controlled in the analysis; however, if there was a higher potential for health care use or expenditures in the comparison group, then our results would be conservative. Finally, some of the outcomes examined, including homelessness, addiction, and depression, may influence program participation and contribute to the lack of findings in the RTC analysis. These factors were balanced in the participant analysis; accordingly, these latter results may provide a better reflection of the true influence of the intervention.

CONCLUSIONS

Our findings are applicable to other start-up, care management programs targeted to high-cost, high-risk Categorically Needy Aged, Blind, and Disabled Medicaid beneficiaries with a high prevalence of addiction, serious mental illness, and other chronic conditions. We found little evidence of cost savings in the target population. Nonetheless, results of the participant analysis suggest that the KCCP care management intervention increased access to needed care (including prescription drugs, long-term care services, particularly in-home services, and drug/alcohol treatment services), improved housing outcomes, and may have averted costly hospitalizations preceded by an ED visit. For these reasons, the KCCP care management model may offer promise to future efforts integrating primary and behavioral health care. Recommendations for future programs include finding cost-effective ways to deliver services, development of improved recruitment and engagement strategies, and longer follow-up in evaluation efforts.

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SUPPORTING INFORMATION

Additional supporting information can be found in the online version of this article:

Appendix SA1: Author Matrix.