

Results from two randomized clinical trials evaluating the impact of quarterly recovery management checkups with adult chronic substance users

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ABSTRACT

Aims Post-discharge monitoring and early reintervention have become standard practice when managing numerous chronic conditions. These two experiments tested the effectiveness of recovery management checkup (RMC) protocols for adult chronic substance users. **Intervention** RMC included quarterly monitoring; motivational interviewing to provide personalized feedback and to resolve ambivalence about substance use; treatment linkage, engagement and retention protocols to increase the amount of treatment received. **Participants and setting** Recruited from sequential addiction treatment admissions, participants in the two experiments were, on average, 36 and 38 years of age, mainly female (59% versus 46%), African American (85% versus 80%) and met past-year criteria for dependence (87% versus 76%). **Design** Participants in both experiments were assigned randomly to the RMC or control condition and interviewed quarterly for 2 years. **Measurement** The Global Appraisal of Individual Needs (GAIN) was the main assessment instrument. **Findings** RMC participant outcomes were better than control participants in both experiments. Effect sizes were larger in the second experiment in terms of reducing days to readmission (Cohen's $d = 0.41$ versus $d = 0.22$), successive quarters in the community using substances ($d = -0.32$ versus -0.19), past-month symptoms of abuse/dependence ($d = -0.23$ versus -0.02) and increasing the days of abstinence over 2 years ($d = +0.29$ versus 0.04). **Conclusion** RMC, which provided ongoing monitoring and linkage, is feasible to conduct and is effective for adults with chronic substance dependence.

Keywords Chronic dependence, controlled clinical trial, effectiveness, longitudinal, recovery management, substance abuse treatment.

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INTRODUCTION

A growing body of evidence demonstrates that severe alcohol and drug use often constitutes a chronic condition marked by cycles of recovery, relapse and repeated treatments often spanning many years before reaching either stable recovery, permanent disability or death [1]. While the majority of people with life-time substance dependence eventually enter sustained recovery (i.e. no symptoms for the past year), most do so after participating in multiple episodes of treatment [2]. Of the people admitted to the US public treatment system in 2003, 64% were re-entering treatment, including 23% for the second time, 22% for the third to fourth times and 19% for the fifth or more times [3]. Moreover, in an evaluation of more than a decade of treatment participation data in the

United Kingdom, Beynon and colleagues [4] found that the trend towards shorter lengths of stay was associated with increasing rates of continued drug use at discharge and readmission within the year.

Retrospective and prospective treatment studies also report that most participants who achieve stable recovery do so after three to four episodes of treatment over multiple years [2, 5]. Dennis and colleagues [2] found recently that the median time from first use to a year of abstinence was 27 years, and the median time from first treatment to a year of abstinence was 9 years, with three to four treatment episodes. Studies have also demonstrated the cyclical nature of addiction by documenting the transitions between relapse, treatment and recovery over time. Scott and colleagues [6] looked at the frequency and direction of transitions between points in the relapse, treatment

re-entry and recovery cycle over 2 years and found that approximately 33% moved from one point in the cycle to another each quarter; 82% transitioned at least once; and 62% transitioned multiple times.

These prolonged, complex service histories are especially prevalent when addiction is accompanied by one or more psychiatric or social pathologies—a significant finding given the high rate of co-occurring disorders among those entering addiction treatment [7]. The protracted course of severe dependence is in line with the course of other chronic conditions: only 27% of patients with hypertension have blood pressures under control, 46% of diabetics have hemoglobin Hba1c levels below 7, and similarly distressing statistics can be found for patients with congestive heart failure, chronic arterial fibrillation, asthma and depression [3]. Unlike conditions or illnesses that are time-limited and treatable in single episodes of acute care, chronic conditions ebb and flow over long periods of time, and their course is not altered fundamentally by acute episodes of stabilization.

Historically, most health-care systems, including addiction treatment, have been organized around an episodic relationship in which a person seeks treatment, receives an assessment, is treated and presumed cured—all in a relatively short period of time. In the addictions field, policy makers, clinicians, patients and their families and the public often have the unrealistic expectation that all patients entering addiction treatment should maintain life-long abstinence following a single episode of specialized treatment. The reality that the majority of people leaving treatment will resume alcohol and drug use in the first year following treatment, most within the first 30–90 days, challenges these expectations [5,6,8,9]. Studies conducted in a wide range of countries including Australia [10,11], Sweden [12], Spain [13], Thailand [14], the United Kingdom [15,16], and the United States [17,18] indicate that, unfortunately, allowing people to continue using in the community has been associated consistently with a 6–11 times higher risk of death. These post-treatment relapse rates and increased risk of mortality demonstrate the need for multiple treatments over long periods of time, invalidate the traditional assumption that a single episode of treatment should result in immediate and long-lasting positive outcomes and challenge the adequacy of an acute-care model of treatment for individuals suffering from chronic substance use.

In other fields, ongoing management of chronic conditions has impacted positively the severity and progression of these conditions, even when such conditions themselves cannot be prevented or cured [1,2,19]. In a recent review of 22 continuing-care studies (conducted in Hong Kong, Sweden, Taiwan and the United States), only 38% of the studies that worked with clients for fewer

than 3 months produced positive findings, whereas 44% of the studies that worked with clients for 4–12 months, and 100% of the studies that worked with clients for more than 12 months [20], produced positive results. In addition to working with clients over longer periods of time, more effective interventions were also characterized as being more 'assertive' with regard to contacting clients, flexible scheduling/placement to accommodate client choice and including recovery support services (including self-help). Kristenson and colleagues [12,17] experimented with the use of quarterly checkups up to 4 years as part of physician visits in Sweden. Participants who received such checkups reported fewer days of being sick and fewer hospital days in the first 6 years and had lower mortality rates over 10–16 years.

Building upon both general chronic-care models and these addiction specific studies, Scott and colleagues developed and tested a recovery management checkup model (RMC) [6,8,21–23]. The core assumption underlying this work is that long-term monitoring through regular checkups and early reintervention will facilitate early detection of relapse, reduce the time to treatment re-entry and consequently improve long-term participant outcomes. This approach does not rely upon participants to identify their symptoms and return to treatment. Instead, these checkups are proactive and include quarterly assessments and personalized feedback for each participant on the status of their condition. Staff use motivational interviewing (MI) techniques to involve participants in the decision-making process about their care by helping them resolve their ambivalence about their dependence and move towards a commitment to change.

The initial early reintervention (ERI-1) experiment established the feasibility and efficacy (altered treatment–relapse cycle and improved outcomes) of conducting quarterly recovery management checkups (RMC) in cases of severe chronic addiction [6,21]. Results indicated that RMC participants were significantly more likely than those in the control group to return to treatment, to return to treatment sooner and to spend more subsequent days in treatment. RMC participants also experienced significantly fewer total quarters in need of treatment and were less likely to need treatment 2 years after intake. However, in spite of the successful linkage rates, only 39% of the linked participants remained in treatment for 14 or more days. Given that individuals who stayed for 14 or more days were significantly more likely to end the quarter in recovery, improving engagement and retention rates is clearly a challenge for ongoing management of this condition.

While results from ERI-1 were encouraging, it took 2 years for the intervention to impact upon participant outcomes significantly. Using data from a combination of sources (weekly management reports, quality assurance

feedback and participant outcome data), the strengths and weaknesses of the original protocol were evaluated and changes to the original RMC protocol were integrated into the second experiment (ERI-2). These evidence-based modifications to the RMC protocol included transportation to treatment and an engagement specialist to improve treatment engagement and retention and were incorporated into ERI-2. The goals of this paper are to evaluate our ability to replicate the RMC model, improve implementation and evaluate the effectiveness of the modified RMC protocol on participant outcomes.

METHODS

Overview

The target population for both experiments was individuals presenting for publicly funded addiction treatment on the west side of Chicago, Illinois, USA. Participants were recruited at the time of their intake assessment and were referred to all levels of care depending on their need. All levels of care were also available to participants in the experimental group over the duration of the study. At intake there were no significant differences in the percentage of clients placed into residential treatment (64% in ERI-1, 81% in ERI-2) or in the average length of stay of their index episode of treatment (32 days in ERI 1 and 45 in ERI 2).

The first experiment (ERI-1) has been completed and involved quarterly checkups for 2 years. The first 24 of 48 months of the second experiment (ERI-2) have also been completed. In this paper, the 24-month participant outcomes from ERI-1 and ERI-2 will be compared. The main data sources for the process or implementation measures included daily staff logs, weekly management reports and participant self-report. The main data source for participant outcomes in both studies was the Global Appraisal of Individual Needs (GAIN) [24] administered at intake and each quarterly assessment thereafter for 2 years.

In both experiments, participants were recruited from sequential intakes at the largest addiction treatment agency in Illinois (intent-to-treat sample). In the first experiment, 84% (448/533) of eligible people agreed to participate and 93% (446/480) agreed in the second experiment. Participants in both experiments were assigned randomly to the control group (quarterly follow-up interviews only) or to the experimental group (quarterly follow-up interviews plus RMC).

Close to 95% of the participants in both experiments completed at least one follow-up interview (96% in ERI-1 and 94% in ERI-2) and most completed all eight (82% and 87%). There were no significant differences by condition in the quarterly follow-up rates for both studies. In

ERI-1 across all quarters, an average of 93% of the RMC participants (quarterly rates ranged from 91% to 96%) completed their interview, and an average of 95% of the control participants completed their interviews (range: 92–98%). In ERI-2 across all quarters, an average of 95% of the RMC participants (range: 93–97%) and an average of 95% of the control participants completed their interviews (range: 94–98%).

All quarterly checkups were scheduled in 90-day intervals post-intake. For example, the second quarterly assessment was scheduled 180 days post-intake. In ERI-1, 88–95% of the interviews were completed within plus or minus 14 days of the anniversary date. In ERI-2, 91–98% were completed within plus or minus 14 days of the anniversary date. Of those assigned to the experimental condition, most were in need of and received the RMC intervention in one or more quarters (77% and 87%; 13% and 15% for one quarter; 64% and 72% for multiple quarters).

The first set of analyses focused on process measures to determine how well the intervention was implemented in both experiments in terms of: (i) locating participants for their quarterly interview and determining their need for treatment; (ii) completing the intervention following the assessment (RMC only); (iii) motivating participants to agree to an intake assessment for readmission to treatment; (iv) completing the intake assessment; (v) accessing treatment; and (vi) remaining in treatment for 14 or more days. It was hypothesized that the process measures would be better in ERI-2 than ERI-1.

Within both experiments, it was hypothesized that relative to participants assigned to the control group, RMC participants would: (i) return to treatment sooner; (ii) receive more total days of treatment; (iii) experience more days of abstinence; (iv) have fewer successive quarters of unmet need for treatment; and (v) be less likely to be in need of further treatment at the end of the study period. Note that treatment participation is both a process measure and an intermediary outcome measure. To control for sample differences, the quasi-experimental comparison of the effects in both experiments measures the relative difference between conditions using Cohen's effect size d . Sample sizes were designed to have 80% or more power to detect an effect size of $d = 0.2$ or more. To rule out the possibility that observed differences were due only to sample differences between the two cohorts, outcome analyses were replicated with a propensity score adjustment for participant characteristics.

Eligibility criteria

In both experiments, individuals were included if they: (i) met life-time criteria for substance abuse or dependence; (ii) used alcohol or other drugs during the 90 days prior

to intake; (iii) completed an intake assessment and received a referral to any level of addiction treatment at the collaborating treatment agency; and (iv) were 18 years of age or older. Logistical constraints in providing the RMC intervention required that individuals be excluded if they (i) did not reside in the City of Chicago; (ii) did not plan to reside in the city during the ensuing 12 months; (iii) had been sentenced to jail or prison or a driving under the influence (DUI) program for most of the upcoming 12 months; (iv) were unable to speak and understand English or Spanish; or (v) were too impaired cognitively to provide an informed consent. Participation was voluntary after an informed consent process under the supervision of Chestnut Health System's Institutional Review Board on Human Subjects, and the study was conducted under the protection of a Federal Certificate of Confidentiality issued by the National Institute on Drug Abuse (NIDA).

Randomization

The second author used an Excel file to sort participants by interview date and research identity verification (ID), and then assigned them randomly to the control or RMC conditions for the duration of the study. Assignments were blocked into groups of six to prevent runs to one condition. The field coordinator was notified of all assignments and research assistants communicated individual assignments to participants during the first quarterly follow-up interview. The study was not blind, because staff needed to transfer participants to the linkage managers to conduct the RMC intervention following the interview and to schedule RMC participants for longer periods of time in order to accommodate the linkage meeting. To control for contamination, randomization was performed externally by the second author, all interviews and linkage meetings were audiotaped (and a random sample reviewed) and different conducted interviews and the intervention with RMC participants.

Sample characteristics

Table 1 shows the intake characteristics by intake cohort and experimental condition within cohort. All participants were presenting to publicly funded addiction treatment. The first cohort was younger (36 versus 38 mean years of age) and significantly more likely to be female (59% versus 46%), African American (85% versus 80%) and to meet past-year criteria for dependence (87% versus 76%), internalizing disorders (75% versus 53%), externalizing disorders (45% versus 33%) and violence/crime problems (60% versus 54%). The first cohort was also more likely to have a history of addiction treatment (68% versus 62%) and less likely to have had involvement with the criminal justice system (75% versus 83%) or to

be referred to residential treatment (65% versus 81%). Randomization largely worked in both experiments (with less than 5% of differences significant). In ERI-1, the one significant difference was that the control group was more likely than the RMC group to meet past-year criteria for alcohol dependence (42% versus 31%). In ERI-2, the two significant differences were that the control group was more likely than the RMC group to have been homeless in the month before intake (32% versus 22%) and to report past-year acts of violence or crime (59% versus 48%).

Control condition

Participants assigned randomly to the control condition in both experiments were interviewed at baseline and again quarterly thereafter. The majority of quarterly assessments were conducted face-to-face at the research office. They required approximately 30–45 minutes to complete, and all on-site assessments were audiotaped for purposes of quality assurance. Once the assessment was completed, the research assistant updated the locator information and scheduled the next appointment.

RMC condition

As with the control group, research staff conducted baseline and quarterly interviews with participants assigned to the experimental RMC condition. The goals of the RMC manual-guided protocol [22,23] were to identify current substance users living in the community and to provide them with an immediate linkage to treatment, thus expediting the recovery process. In both experiments, RMC involved the following key steps: (i) locating the person for a follow-up interview; (ii) determining the eligibility for the intervention (i.e. verifying that the person was not already in treatment or jail and was living in the community) and need for treatment; (iii) transferring participants in need of treatment from the interviewer to the linkage manager for the intervention; (iv) obtaining participant agreement for an intake assessment for treatment; (v) linking participants to the intake assessment; (vi) linking participants to treatment; and (vii) sustaining participation in treatment for at least 14 days.

During the intervention, linkage managers used motivational interviewing techniques to provide personalized feedback to participants on the status of their condition and related problems, helped participants to resolve their ambivalence about their dependence and move towards a commitment to change by accessing additional care, address existing barriers to treatment and schedule an assessment and facilitate reentry (reminder calls, transportation). Motivational Interviewing (MI) is an effective evidence-based method for resolving the ambivalence that prevents many individuals from making desired changes in their lives [25].

Table 1 Participant characteristics by randomized condition and study cohort.

Characteristics (column % unless noted)	ERI-1			ERI-2		
	Control (n = 224)	RMC (n = 224)	Total (n = 448)	Control (n = 223)	RMC (n = 223)	Total (n = 446)
Female ^c	58%	61%	59%	49%	42%	46%
Race/ethnicity						
African American ^c	86%	84%	85%	78%	82%	80%
Hispanic	5%	6%	6%	3%	1%	2%
Caucasian	6%	9%	8%	9%	7%	8%
Mixed/other	3%	1%	2%	11%	10%	10%
Age (mean) ^c	36	36	36	38	39	38
Past-month employment	23%	24%	23%	24%	26%	25%
Past-month homelessness ^b	35%	27%	31%	32%	22%	27%
Life-time physical, sexual or emotional victimization	74%	75%	75%	72%	71%	71%
History of traumatic levels of victimization	60%	61%	61%	59%	52%	56%
Victimized in 90 days before intake	15%	17%	16%	17%	17%	17%
Past-year substance use disorder ^c	92%	94%	93%	87%	87%	87%
Any dependence ^c	86%	88%	87%	79%	73%	76%
Alcohol dependence ^{a, c}	42%	31%	36%	20%	21%	20%
Cocaine dependence ^c	66%	68%	67%	60%	52%	56%
Opioid dependence ^c	27%	30%	29%	21%	21%	21%
Cannabis dependence ^c	9%	7%	8%	4%	4%	4%
Any other dependence ^c	1%	2%	1%	1%	1%	1%
Any abuse ^c	22%	20%	21%	27%	31%	29%
Life-time SUD treatment ^c	70%	67%	68%	64%	60%	62%
Treatment in the past 90 days	24%	24%	24%	19%	19%	19%
Referred to residential at intake ^c	66%	69%	65%	81%	80%	81%
Any past-year internalizing disorder ^c	75%	74%	75%	57%	49%	53%
Depression ^c	63%	59%	61%	53%	45%	49%
Anxiety ^c	61%	59%	60%	29%	22%	26%
Trauma ^c	43%	45%	44%	32%	28%	30%
Suicidal ^c	34%	37%	36%	13%	10%	11%
Any past-year externalizing disorder ^c	46%	45%	45%	34%	31%	33%
Attention deficit/hyperactivity ^c	36%	32%	34%	28%	24%	26%
Conduct disorder ^c	36%	37%	37%	26%	24%	25%
Life-time previous mental health (MH) treatment	28%	26%	27%	32%	26%	29%
MH treatment in the past 90 days	13%	10%	11%	15%	13%	14%
Any past-year crime/violence problems ^b	58%	63%	60%	59%	48%	54%
Physical violence towards others ^c	43%	51%	47%	48%	39%	43%
Drug-related crime ^c	32%	31%	32%	26%	21%	23%
Property crime ^c	26%	32%	29%	21%	17%	19%
Interpersonal violent crime	14%	17%	16%	13%	9%	11%
Life-time criminal justice system involvement ^c	72%	77%	75%	81%	85%	83%
Criminal justice involvement in past 90 days ^c	31%	34%	33%	47%	42%	45%

^aSignificant difference between conditions in study early reintervention (ERI-1), $P < 0.05$. ^bSignificant difference between conditions in study ERI-2, $P < 0.05$. ^cSignificant difference between studies, ERI-1 total versus ERI-2 total, $P < 0.05$. RMC: recovery management checkup; SUD: substance use dependence.

While the intervention was successful in ERI-1, it required 24 months and seven checkups to impact participant outcomes. To improve the model, implementation data from the first experiment guided the design of two main modifications to the original RMC protocol. Data from ERI-1 indicated that providing transportation increased the chances that participants would complete the intake and the first treatment appointments. There-

fore, transportation was a required component for ERI-2. In ERI-1, only 39% of the people who accessed treatment stayed for 14 days or more. Moreover, clients who received 14 or more days of treatment were significantly less likely than those with less than 14 days to end the quarter in 'need of treatment' [25% versus 48%, odds ratio (OR) = 0.36, 95% confidence interval (CI) = 0.24–0.54, $P < 0.05$]. While the RMC intervention

increased treatment participation significantly, it did not impact retention rates. To address this challenge, a highly specified treatment engagement and retention protocol was implemented in ERI-2. The protocol included a specific telephone and face-to-face contact schedule and an agreement between treatment and research staff that the linkage manager would have the opportunity to conduct an intervention with participants who wanted to leave treatment or that staff wanted to ask to discharge prematurely.

Staff training, supervision and quality assurance

In both experiments, research staff completed a formal training program and participated in ongoing quality assurance to achieve high adherence to project protocols. To maintain fidelity of the MI intervention, all linkage meetings were audiotaped and reviewed by an external MI expert until the linkage managers were certified prior to intervention implementation. Following certification, a random sample of tapes was reviewed throughout the study. In ERI-1 both linkage managers had General Educational Developmental (GED) qualifications and in ERI-2 both held master's degrees. In both experiments, all interviewers were certified to use the GAIN and the linkage managers received the same MI training and similar quality assurance monitoring.

Instruments and measures

Process or implementation variables were measured through daily staff contact logs that were entered daily and reviewed weekly. The participant characteristics, diagnosis and primary outcomes were measured using the GAIN [24]. The GAIN is a comprehensive, structured interview that has eight main sections (background, substance use, physical health, risk behaviors, mental health, environment, legal and vocational) with good internal consistency (alpha over 0.90 on main scales, 0.70 on subscales), test-retest reliability (Rho over 0.70 on days/problem counts, Kappa over 0.60 on categorical measures), and is consistent with time-line follow-back, urine tests, collateral reports, treatment records and blind psychiatric diagnosis (Rho of 0.70 or more; Kappa of 0.60 or more) [26–29]. Table 2 lists the definitions of the process and participant outcome measures reported in this paper. For the outcome measures it includes reliability in terms of the Cronbach's alpha for a scale, Spearman's rank order correlation (Rho) for test-retest of continuous variables, and Kappa (κ) for test-retest of dichotomous measures. The latter two are from a test-retest study conducted as part of the final (24-month) wave of ERI-1 data collection, as reported in Dennis *et al.* [21]. Copies of the full GAIN and more detailed informa-

tion on the GAIN scales and created variables are available publicly at <http://www.chestnut.org/li/gain>.

In both experiments urine samples were collected at 12 and 24 months in conjunction with on-site interviews. The urine results were used to improve the validity of self-report and not used to determine need for treatment. In ERI-1 the rate of false negatives (i.e. denying past-month use but positive on the urine test) was 9% at 12 months and 15% at 24 months. To reduce the rate of false negatives in ERI-2, the team adopted a new feedback protocol involving a review of substances reported in previous interviews, on-site urine testing, giving results immediately and probing any inconsistencies of these two sources with subsequent self-reported recency of use. The ERI 2 feedback protocol was associated with significantly lower false negative rates at both 12 months (9% versus 3%; $d = 0.13$, $\chi^2_{(1)} = 13.89$ $P < 0.05$) and 24 months (15% versus 2% false negative; $d = 0.25$, $\chi^2_{(1)} = 40.43$, $P < 0.05$).

Analytical procedures

All analyses were performed with SPSS version 14.0 [30] using an 'intent-to-treat' model [31]. This means that (i) people were analyzed as assigned randomly, regardless of whether they needed or received RMC services; and (ii) for the small amount of missing data by wave, we imputed the answers as noted in Table 2. Data were used from all available interviews (98% of ERI-1 and 97% of ERI-2).

The first set of analyses focused on the process measures (e.g. % followed-up, % in need of RMC, % completing linkage meeting, % agreeing to go to an assessment, % receiving an assessment, % accessing treatment, % engaging in treatment for 14 or more days), where the degree of implementation of RMC was evaluated by looking at the average across quarters (with increases indicating improvement) and the quarter-to-quarter variation (where a smaller range demonstrates better implementation). The average differences between RMC in ERI-1 and 2 were tested using a mixed model nominal regression with Hedeker [32] MIXNO and reported in terms of the Z-score of the Wald statistic.

The second set of analyses focused on participant outcomes that RMC intervention targeted for improvement. Note that treatment participation is both a process measure and an intermediary outcome measure. Cox proportional hazard survival analysis was conducted on the time from the 3-month interview (point of randomization) to first subsequent readmission, treating people who had not returned to treatment by their last interview as right censored (i.e. they had not re-entered treatment; 42% of ERI-1 and 54% of ERI-2 observations were right censored). For categorical outcome measures (e.g. % re-entered treatment, % needing treatment at the last

Table 2 Summary of key measures from Global Appraisal of Individual Needs (GAIN).**Adherence and implementation measures (from staff logs)**

- 1 *Follow-up rate*: the number of RMC participants completing quarterly assessments divided by the number of 'the number of RMC participants minus those who had died'
- 2 *Treatment need rate*: the number of RMC participants living in the Chicago metropolitan area and meeting 'in need of treatment' criteria (see below) divided by the number of RMC participants 'completing quarterly assessments'
- 3 *Linkage meeting attendance rate*: the number of RMC participants attending a 'linkage meeting' for the intervention divided by the number of RMC participants meeting 'in need of treatment' criteria
- 4 *Agreed to assessment rate*: the number of RMC participants 'agreeing to go to an intake assessment for readmission to addiction treatment' divided by the number of RMC participants meeting 'in need of treatment' criteria
- 5 *Assessment completion rate*: the number of RMC participants who completed the intake assessment divided by the number of RMC participants meeting 'in need of treatment' criteria
- 6 *Treatment access rate: showing for treatment*: the number of RMC participants who went to treatment divided by the number of RMC participants meeting 'in need of treatment' criteria
- 7 *14+ treatment days engagement rate*: the number of RMC participants who 'stayed 14 or more days in treatment' divided by the number of RMC participants who 'went to treatment' in the same quarter

Outcome measures (from self-report on GAIN)

- 1 *Re-entered treatment* (%; test-retest kappa = 0.81). Whether the person re-entered treatment after the point of randomization (at 3 months) and the final interview (at 24 months or last interview)
- 2 *Total days received treatment* (mean = 48 and SD = 80.38; test-retest Rho = 0.93). Based on the sum of days an individual received out-patient, intensive out-patient, residential or in-patient treatment reported at each interview for a given period
- 3 *Total days of abstinence* (mean = 475 and SD = 170.39; test-retest Rho = 0.99). Sum of days abstinent from months 4 to 24 (max = 630 days) using the mean days per quarter for any missing observations
- 4 *Successive quarters of unmet need for treatment* (mean = 2.20 and SD = 2.32; test-retest Rho = 0.92). The number of quarters in which the individual started and ended the period 'in need of treatment' (see definition below) where missing data were replaced with status at previous wave. Note that this is the primary measure of 'clinically significant change'
- 5 *Days of abstinence in the last quarter* (mean = 68 and SD = 31.11; test-retest Rho = 0.94). Days abstinent (of 90) reported at the 24-month interview, using the last interview for any missing observation
- 6 *Past-month Substance Problem Scale (SPS)* (mean = 2.5 and SD = 4.16; alpha = 0.93; test-retest Rho = 0.81). Count of 16 past-month items related to weekly use, hiding using, complaints about use, four symptoms of abuse, seven symptoms of dependence, substance-induced health or mental health problems
- 7 *In need of treatment* (%; test-retest kappa = 0.78). Defined as a participant living in the community (versus in incarcerated or in treatment) who was not already in treatment and answered 'yes' to any of the following questions: (i) During the past 90 days, have you used alcohol, marijuana, cocaine, or other drugs on 13 or more days? (ii) During the past 90 days, have you got drunk or been high for most of 1 or more days? (iii) During the past 90 days, has your alcohol or drug use caused you not to meet your responsibilities at work/school/home on 1 or more days? (iv) During the past month, has your substance use caused you any problems? (v) During the past week, have you had withdrawal symptoms when you tried to stop, cut down, or control your use? (vi) Do you feel that you need to return to treatment? These criteria for need are internally consistent (alpha = 0.85) and the average person in need endorsed 3.3 of six of the items (80% endorsed two or more)

RMC: recovery management checkup; SD: standard deviation.

quarterly observation), the differences between conditions were tested using an exact χ^2 . For most of the continuous participant outcome measures (e.g. total days of treatment, total days of abstinence, the number of successive quarters of unmet need for treatment, days of abstinence in the last quarterly observation and past-month substance problem scale count of abuse/dependence symptoms), reliable differences were tested with analysis of covariance and reported in terms of an *F*-statistic for the condition (experimental versus control) with the baseline and 3-month values of the respective dependent variables as covariates.

Because the two experiments were conducted with separate time cohorts (2000 versus 2004), the RMC versus control differences for each experiment were

compared conservatively in terms of their within study effect sizes in the same way that this issue is handled in a meta-analysis. The process and outcome figures and tables include Cohen's effect size *d*, where $d = \pm 0.2$ is considered small, $d = \pm 0.4$ is medium size and $d = \pm 0.8$ or more is large. If the *d* was 0.2 or greater but the alpha was greater than 0.05, we referred to this as a 'trend'. To rule out the possibility that observed differences were due only to sample differences between the two cohorts, outcome analyses were replicated with a propensity score adjustment for participant characteristics. Specifically, the propensity (i.e. probability) of being in the second experiment (versus the first) given the characteristics in Table 1 was calculated and saved to the combined data file. This propensity score was added to the outcome

Table 3 Effectiveness of recovery management checklist (RMC) over control by early reintervention (ERI) experiment.

Outcome variable	Good is:	ERI-1 (months 4–24)			ERI-2 (months 4–24)		
		Control	RMC	Cohen's <i>d</i>	Control	RMC	Cohen's <i>d</i>
Between months 4 and 24 (630 days)							
Re-entered treatment	Up	51%	60%	0.21*	37%	55%	0.40*
Total days of treatment	Up	40	63	0.27*	36	53	0.23*
Total days of abstinence	Up	490	497	0.04	430	480	0.29*
No. of successive quarters of unmet need for treatment	Down	2.31	1.86	(0.19)*	3.41	2.59	(0.32)*
At 24-month interview							
Days of abstinence (out of 90)	Up	72	71	-0.05	61	68	0.23*
Past-month symptoms on SPS (out of 16)	Down	2.3	2.3	(0.02)	3.0	2.1	(0.23)*
In need of treatment at last wave	Down	44%	34%	(0.21)*	57%	46%	(0.24)*

**P* < 0.05. SPS: Substance Problem Scale.

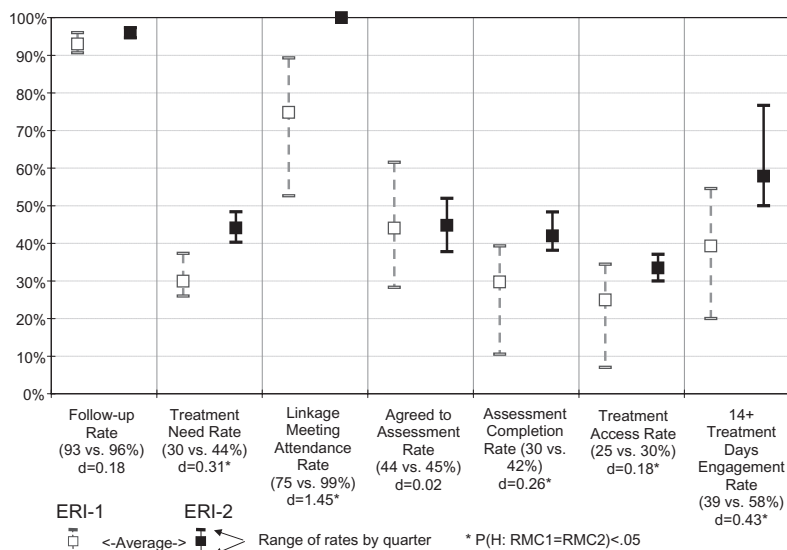


Figure 1 Recovery management checklist (RMC) protocol adherence rate by experimental cohort

analyses related to Figs 2 and 3 and Table 3. If this propensity score adjustment ‘reduced’ the differences between studies, it suggests the possibility that the improved outcomes might be due to subject differences in the sample. Conversely, the extent to which the propensity adjustment had no impact or increased the size of the difference between studies suggests that the observed improvements are more likely to be due to the differences in the RMC intervention and its implementation.

RESULTS

Adherence: how well was the model implemented?

Figure 1 shows the average and range by quarter for each variable used to assess the quality of implementation or adherence to the RMC model for ERI-1 and ERI-2. High follow-up rates were achieved across quarters in each experiment [93% in ERI-1 versus 96% in ERI-2 of those

randomized; *d* = 0.18, *Z* = 1.79, not significant (NS)]. In ERI-2, significantly more participants were identified as needing treatment (30% versus 44% of those interviewed; *d* = 0.31, *Z* = 3.95, *P* < 0.001). Part of this improvement in identification was due probably to the reduced rates of false negatives associated with the ERI-2 feedback protocol (discussed previously). Of those who were eligible and in need, significantly more participants in ERI-2 attended the linkage meeting for the intervention (75% versus 99% of those in need; *d* = 1.45, *Z* = 5.86, *P* < 0.001). Of these participants in both experiments, a similar percentage agreed to schedule an intake assessment for readmission to treatment (44% versus 45% of those in need; *d* = 0.02, *Z* = 0.43, NS). Relative to ERI-1, RMC participants in ERI-2 were significantly more likely to complete the intake assessment (30% versus 42% of those in need; *d* = 0.26, *Z* = 2.978, *P* < 0.01), access treatment (25% versus 30% of those in need; *d* = 0.18, *Z* = 1.98, *P* < 0.05) and remain in

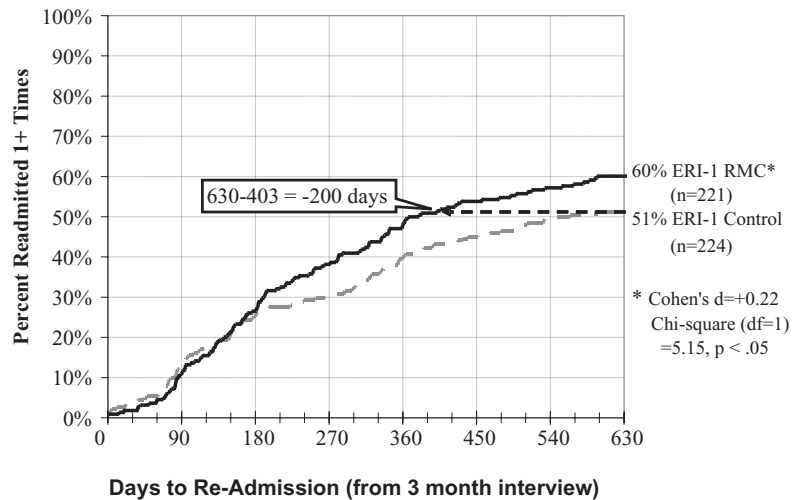


Figure 2 Days to readmission to substance treatment by condition in early reintervention (ERI-1)

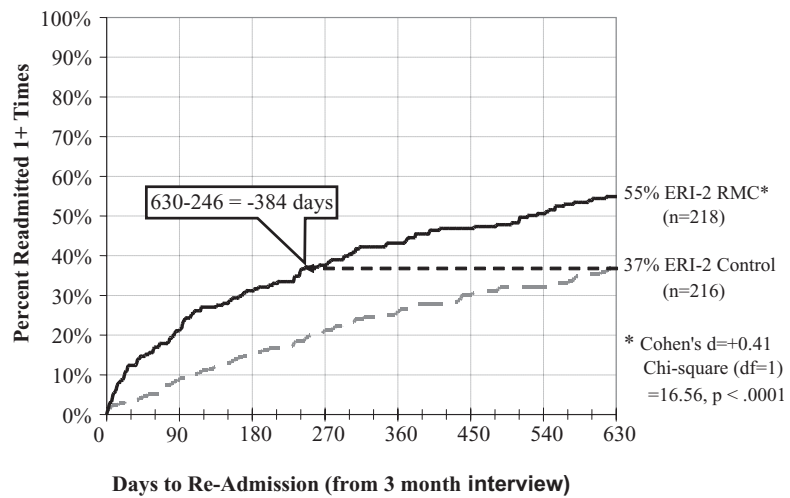


Figure 3 Days to readmission to substance treatment by condition in early reintervention (ERI-2)

treatment for 14 or more days (58% versus 39% of those in need; $d = 0.43$, $Z = 2.24$, $P < 0.05$). It is important to note that across these variables, the quarter-to-quarter range narrowed in the second experiment, representing more model adherence and fidelity, which speaks to the feasibility of replicating the model.

Participant outcomes (control versus RMC) in ERI-1 versus ERI-2

Time to readmission and treatment received

Figure 2 shows the time from the 3-month interview (point of randomization and the first opportunity for RMC) to the first subsequent readmission for control and RMC participants in ERI-1, and Fig. 3 shows the same information for ERI-2. Unlike Fig. 2, the next analysis compares RMC to the control group and everyone is included as assigned. After discharge from the index episode of care in ERI-1, RMC participants were significantly more likely than control group participants to

return to treatment (51% versus 60%) and return sooner (achieving 51% 200 days earlier) (Cohen’s $d = +0.22$; $\chi^2_{(1)} = 5.15$, $P < 0.05$). After discharge from the index episode of care in ERI-2, RMC participants were also significantly more likely than control group participants to return to treatment (37% versus 55%) and to return sooner (achieving 37% 384 days earlier) (Cohen’s $d = +0.41$; $\chi^2_{(1)} = 16.56$, $P < 0.0001$). Treatment included both in-patient and out-patient programs. Adding the propensity score adjustment slightly reduced the significance and size of the effects in the first experiment and had no effect on the second experiment—suggesting that differences were more probably attributable to the protocol and implementation differences than the subject differences. In addition to achieving a more robust effect, the impact of ERI-2 shows up more prominently in the first 180 days and the horizontal gap to achieve the same percentage in treatment increases over time in both studies. Table 3 contains the outcomes by experiment and condition over the first 2

years. Relative to the control condition, RMC increased significantly the total average days of subsequent treatment received in months 4–24 in both ERI-1 (40 days in control versus 63 days in RMC; $d = 0.27$; $P < 0.05$) and in ERI-2 (36 versus 53 days, $d = 0.23$; $P < 0.05$).

Impact on substance use

In ERI-1, the impact of RMC on dependence was mixed: there was no significant difference in the total days of abstinence or the number of successive quarters of need across months 4–24. However, relative to people in the control group, the RMC participants had more total days in treatment across 4–24 months (40 versus 63 days; $d = 0.27$, $F_{(1, 415)} = 7.76$, $P < 0.05$), fewer successive quarters of unmet need for treatment (2.31 versus 1.86 quarters; $d = -0.19$, $F_{(1, 446)} = 4.30$, $P < 0.05$) and the RMC participants were less likely to be in the community in need of treatment at month 24 (44% versus 34%, $d = -0.21$, $\chi^2_{(1)} = 4.23$, $P < 0.05$). The improved implementation in ERI-2, in contrast, was associated with more consistent outcomes, with participants assigned to RMC reporting significantly more total days of treatment (36 versus 53 days; $d = 0.23$, $F_{(1, 416)} = 6.27$, $P < 0.05$), more days of abstinence (430 versus 480 days out of 680 days; $d = 0.29$, $F_{(1, 415)} = 9.55$, $P < 0.05$) and fewer successive quarters of unmet need for treatment (3.41 versus 2.59 quarters; $d = -0.32$, $F_{(1, 444)} = 11.85$, $P < 0.001$) across months 4–24. In the last quarter, RMC participants reported significantly more days of abstinence than control participants (61 versus 68 days out of 90; $d = 0.23$, $F_{(1, 422)} = 5.48$, $P < 0.05$), fewer past-month symptoms of abuse, dependence or substance-induced problems (3.0 versus 2.1 out of 16, $d = -0.23$, $F_{(1, 422)} = 5.37$, $P < 0.05$) and were less likely to be in the community in need of treatment at month 24 (57% versus 46%; $d = -0.24$, $\chi^2_{(1)} = 4.56$, $P < 0.05$). Adding the propensity score adjustment to each analysis had no effect on the statistical significance for either experiment and decreased the effect sizes only slightly in the first experiment. This suggests that the differences reported in Table 3 were probably attributable to the protocol differences than the subject differences.

Impact on adverse events

As would be expected in this population, during the 2-year period (across experiments) multiple instances of serious adverse events (SAE) occurred, including medical (53%) or mental (11%) emergency room or hospital admissions, incarcerations (37%) and death (2%), as well as a wide range of other adverse events. However, these rates were lower than the quarter prior to enrollment in the study (and initial treatment). There were no SAE or AE that appeared to be related specifically to randomiza-

tion to RMC according to the principal investigator and data safety monitoring board, and generally no significant differences between RMC and the control group in rates of a wide range of SAE or AE. The exceptions in ERI-1 were that relative to the control group, RMC participants were significantly more likely to have a period of any incarceration (40–25%, $\chi^2_{(1)} = 10.38$, $P < 0.05$, $d = 0.30$), but were not significantly different in terms of the days of incarceration or days of illegal activity. In ERI-2 when compared to control group participants, RMC participants reported significantly fewer days of problems due to AOD use (32.2–48.3, $F_{(1, 434)} = 4.44$, $P < 0.05$, $d = -0.19$) and significantly fewer days of arguing/fighting (29.1–40.1, $F_{(1, 435)} = 4.56$, $P < 0.05$, $d = -0.17$). Thus, the SAE/AE rates appear to be primarily a function of the clinical severity of the samples.

DISCUSSION

The goals of this paper were to explore the replicability of the revised RMC model and to evaluate its impact on implementation and participant outcomes. Components of the RMC model were designed to address the duration and cyclical nature of dependence via quarterly monitoring and linkage to treatment. These regular checkups provided a proactive approach to help participants learn to identify symptoms and resolve their ambivalence about their substance use; to offer the opportunity for multiple episodes of care in the context of chronic-care management; and to include an engagement and retention component to retain participants in treatment.

Data from ERI-1 demonstrated the feasibility of implementing quarterly monitoring and recovery management checkups as well as the impact on participant outcomes 2 years after the initial treatment episode. Data from ERI-2 provided evidence regarding the feasibility of replicating the RMC model and improving its implementation. In both experiments, the team achieved high follow-up rates and high participant agreement to return to treatment. Relative to ERI-1, however, in ERI-2 RMC participants were more likely to be identified as in need of treatment (30 versus 44%), attend the linkage meetings (75% versus 99% of those in need), complete the assessment (30% versus 42% of those in need), access treatment (25% versus 30% of those in need) and remain in treatment for at least 14 days (39% versus 58% of those starting treatment).

Results also indicated that modifications to the RMC model facilitated and improved the consistency with which the protocols were implemented (e.g. the quarter-to-quarter range in implementation narrowed in the second experiment). Thus, the RMC intervention probably contributed to more participants returning to treatment sooner and improved participant outcomes. The

control group participants, in contrast, continued to use substances in the community for more successive quarters, which is consistent with prior findings on the natural cycle of relapse, treatment and recovery [6,8]. The current findings are also significant in light of previous research suggesting that people who do not return to treatment after relapse are likely to 'deteriorate' further until they do [33]. It is also consistent with continuing-care research that longer-term and more assertive monitoring can improve outcomes [20]. Thus, the clinically significant reduction in the successive quarters of unmet need for treatment shown in these experiments demonstrates the effectiveness of RMC for managing dependence over time. Moreover, the effect size of these gains was as much as twice as large in ERI-2 than in ERI-1.

Strengths and limitations

These two experiments have numerous strengths: the sample sizes, repeated observations, high follow-up rates, detailed measurement, randomization and replication across two cohorts. However, it is also important to note the limitations. First, the comparison of RMC in two experiments is based on two time cohorts (recruited in 2000 versus 2004) and is hence quasi-experimental in nature. While the samples were recruited from the same addiction treatment program using the same inclusion/exclusion criteria, shifts in the participant characteristics and treatment personnel confound the contrasts presented here. The finding that propensity score adjustments had either no effect or increased the differences between studies suggests that differences are not due to participant characteristics. Secondly, urine-testing procedures differed in the two experiments with the ERI-2 method, resulting in significantly lower false negative rates. Thus, the days of abstinence reported for ERI-1 are probably an overestimate and, again, the improvement of ERI-2 over ERI-1 is probably *larger* than reported here. Thirdly, for logistical reasons we limited recruitment to a single site with predominately African American inner-city participants with high rates of co-occurring mental disorders, homelessness and criminal justice system involvement. In the future, it would be useful to replicate this work with a more representative sample of the US public treatment system, in other countries and/or less severe clinical samples.

Implications

Addiction, as with other chronic conditions, is often marked by cycles of relapse, multiple treatments and intermittent periods of abstinence over many years before reaching sustained recovery. Results from the two ERI studies provide evidence that ongoing monitoring, feedback and early reintervention can be effective methods of

managing recovery over time. Ideally, such services would become a requirement for treatment program licensure, accreditation and funding. Those requirements would be best linked to a larger strategy of reorienting addiction treatment from a predominantly acute-care model of intervention to a service model that provides services ranging from a brief intervention to long-term recovery management. However, the implications of shifting to a chronic-care model are significant. That shift will require a radical redefinition of the continuum of care, new service philosophies, new service delivery technologies and a fundamental rethinking of systems of reimbursement for addiction treatment and recovery support services.

The shift will also require various stakeholders to address a number of critical questions. The first relates to the manner in which post-treatment monitoring, support and early reintervention services can be integrated into the current continuum of care. A second question is how to make these services accessible to all participants who enter treatment with high problem severity, complexity and chronicity.

Another critical question is where (organizationally) and by whom these post-treatment recovery support services will be best delivered. The data supporting recovery management checkups have been generated by services provided by clinical and non-clinical staff employed within a research organization. Additional research is needed to determine if the effectiveness of such services differs across types of organizations or differs based on whether they are delivered by clinical or non-clinical staff. Regardless of who ultimately delivers post-treatment recovery support services, considerable thought will need to be given to the recruitment, orientation, training and supervision of individuals performing these functions. Experience to date suggests the need for a substantial investment in articulating the ethics and etiquette of conducting recovery management checkups across diverse clinical populations and cultural contexts.

An important step in moving forward will be to estimate the costs associated with ongoing monitoring and early reintervention. It may be that RMC will cost more than standard care (significantly more days of treatment by the RMC participants translates into higher costs for this group, at least for treatment provision). Even though the outcome data demonstrate the efficacy of RMC, cost offset (not simply cost) data would be particularly important—it is much more likely that a program would choose to adopt RMC if it not only led to better outcomes but also could be shown to reduce subsequent costs. Other steps might include: (i) testing the model with different populations such as pregnant and postpartum women, male and female offenders leaving jail or prison or adolescents; (ii) determining when a participant can be

transitioned from quarterly to bi-annual checkups based on need; (iii) determining whether more frequent or even continuous monitoring would improve outcomes; and (iv) testing the impact of linkages to less formalized types of care such as recovery coaches or faith-based interventions.

Declarations of interest

None.

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