

Review

A systematic review of the effectiveness of the community reinforcement approach in alcohol, cocaine and opioid addiction

Hendrik G. Roozen^{a,b,*}, Jiska J. Boulogne^a, Maurits W. van Tulder^c,
Wim van den Brink^{d,e}, Cor A.J. De Jong^{f,g}, Ad J.F.M. Kerkhof^a

^a Department of Clinical Psychology, Vrije Universiteit Amsterdam, van der Boechorststraat 1, 1081 BT Amsterdam, The Netherlands

^b Kentron, Centre for Addiction Care, Roosendaal, The Netherlands

^c Department of Clinical Epidemiology & Biostatistics, Institute for Research in Extramural Medicine, Vrije Universiteit Medical Center, Amsterdam, The Netherlands

^d The Amsterdam Institute for Addiction Research, Amsterdam, The Netherlands

^e Academic Medical Centre (AMC), University of Amsterdam, Amsterdam, The Netherlands

^f Novadic, Network for Addiction Treatment Services, St-Oedenrode, The Netherlands

^g Nijmegen Institute for Scientist-Practitioners in Addiction (NISPA), Nijmegen, The Netherlands

Received 7 April 2003; received in revised form 11 November 2003; accepted 18 November 2003

Abstract

The community reinforcement approach (CRA) has been applied in the treatment of disorders resulting from alcohol, cocaine and opioid use. The objectives were to review the effectiveness of (1) CRA compared with usual care, and (2) CRA versus CRA plus contingency management. Studies were selected through a literature search of RCTs focusing on substance abuse. The search yielded 11 studies of mainly high methodological quality. The results of CRA, when compared to usual care: there is strong evidence that CRA is more effective with regard to number of drinking days, and conflicting evidence with regard to continuous abstinence in the alcohol treatment. There is moderate evidence that CRA with disulfiram is more effective in terms of number of drinking days, and limited evidence that there is no difference in effect in terms of continuous abstinence. Furthermore, there is strong evidence that CRA with ‘incentives’ is more effective with regard to cocaine abstinence. There is limited evidence that CRA with ‘incentives’ is more effective in an opioid detoxification program. There is limited evidence that CRA is more effective in a methadone maintenance program. Finally, there is strong evidence that CRA with abstinence-contingent ‘incentives’ is more effective than CRA (non-contingent incentives) treatment aimed at cocaine abstinence.

© 2004 Elsevier Ireland Ltd. All rights reserved.

Keywords: Systematic review; Community reinforcement approach; Alcohol; Cocaine; Opioid

1. Introduction

The community reinforcement approach (CRA) is a biopsychosocial multifaceted approach to change a lifestyle of substance abuse. CRA acknowledges the role of environmental events and influences in habitual abuse, and focuses on alternative positive resources in the social environment (e.g. Meyers and Smith, 1995). CRA is based on the theoretical view that substance-related reinforcers and the relative lack of alternative reinforcers unrelated to substance abuse maintain dependence. In this view, the development of alternative rewarding social activities that are

incompatible with substance use is essential to initiate and maintain abstinence (Schottenfeld et al., 2000).

Emphasis is placed on changing environmental contingencies in the aspects of life, such as labor, recreation, family involvement, etc., to promote a lifestyle that is more rewarding than substance abuse. CRA integrates not only cognitive behavioral interventions, but also pharmacological interventions (e.g. disulfiram). Another operant method, which is widely applied in CRA research, involves voucher-based incentive programs to promote abstinence (Budney and Higgins, 1998). These vouchers are exchangeable for retail items or services, and can be obtained by an individual who has submitted substance-free urine samples.

Despite promising reports of early research (Azrin, 1976; Hunt and Azrin, 1973) on alcohol, CRA has not been widely

* Corresponding author. Tel.: +31-204448759; fax: +31-204448758.

E-mail address: hg.roozen@psy.vu.nl (H.G. Roozen).

implemented (Kadden, 2001). Possible reasons for this are the labor intensity and the relatively high costs (Barber, 1992). In spite of these reasons, the cost-effectiveness of CRA (Wolfe and Meyers, 1999) has placed it high on the list of strongly supported methods for the treatment of alcohol problems that are identified in structured reviews of the literature on treatment outcomes (Finney and Monahan, 1996; Holder et al., 1991; Miller et al., 1995, 1998, 2003; Miller and Wilbourne, 2002). However, in general, these reviews contain only limited number alcohol studies involving CRA, mainly based on the early work of Azrin, which compromises assessments of effectiveness. Although the most recent review (Miller et al., 2003) contains also recent CRA trials. In addition, there seem to be no systematic reviews or meta-analyses available in which the effectiveness of CRA, with or without voucher-based contingency management, is compared with usual care.

The objective of this systematic review was to evaluate the effectiveness of CRA in the treatment of alcohol, cocaine and opioid addiction. Comparisons that were made included:

1. CRA versus usual care;
2. CRA versus CRA plus voucher-based contingency management;
3. CRA versus CRA plus pharmacological support.

2. Methods

2.1. Criteria for considering studies for this review

2.1.1. Types of studies

Only (matched) randomized controlled trials (RCTs) were included.

2.1.2. Types of participants

Subjects with alcohol, cocaine and opiate abuse or dependence (DSM-IV) between 18 and 65 years of age were included. RCTs with subjects whose substance dependence was not the main diagnosis, or whose addiction was not seen as a reason for contact, were excluded (e.g. subjects with a diagnosis of schizophrenia who also have a substance dependency).

2.1.3. Types of interventions

Only RCTs that applied a behavioral approach based on CRA principles were included. RCTs in which only one component of CRA was investigated were excluded. RCTs in which a pharmacological agents (e.g. disulfiram) was administered, combined with psychosocial treatment based on CRA, were also included, as were RCTs based on CRA with pharmacological maintenance treatment (e.g. methadone).

2.1.4. Types of outcome measures

Effectiveness was defined in terms of (1) (continuous) abstinence, determined by urine samples, blood samples

or self-reports. When data on continuous abstinence were not available, abstinence percentages that imply abstinence percentages within a follow-up assessment period were included. Abstinence was regarded as a primary outcome measure in maintenance treatment (e.g. methadone) pertaining to the cessation of illegal drug use (heroin). RCTs were included if at least one of the following outcome measures was used; (2) addiction severity, measured for example according to the ASI, a semi-structured interview that gives a multidimensional profile of the addicted individual and an indication of the addiction severity (McLellan et al., 1980). The ASI contains seven life domains (medical, employment, alcohol, substance, legal, psychiatric, family and social). The composite scores subsequently reflect the severity of each of the seven domains over the previous 30 days; (3) frequency of substance abuse, measured for example according to the number of (heavy) drinking days and time spent drinking; (4) time to relapse.

2.2. Search strategy for identification of studies

Relevant RCTs meeting the inclusion criteria were identified by:

1. A computer-aided search using two search engines: OVID and WebSPIRS. WebSPIRS was used for a search in the following databases: Biological Abstracts, ERIC, LISA, OSH, Periodical Abstracts, PsycINFO, SERFILE and Sociological Abstracts. OVID includes EMBASE, MEDLINE and CINAHL. All databases were searched from the date of commencement. The search was conducted in March 2002, using the highly sensitive search strategy of the UK Cochrane Centre (October 1996), based on the first two stages of the Medline search strategy recommended in the Cochrane Handbook (Appendix V of Section V) and published by Dickersin et al. (1994). This was run in conjunction with a specific search that included combinations of the following keywords: alcohol abuse, substance abuse, drug abuse, alcohol-related disorder(s), opioid-related disorder(s), opiate-related disorder(s), cocaine-related disorder(s), community reinforcement approach, community reinforcement, CRA, disulfiram, acamprosate, methadone, heroin, naltrexone and buprenorphine. Only RCTs that were published in the english language were included.
2. Screening references given in relevant identified trials and reviews.
3. Screening the Cochrane Library, 2002, issue 1.

2.3. Methods of the review

2.3.1. Study selection

Two reviewers (HGR and JJB) independently selected the trials to be included in the systematic review. As the reviewers were acquainted with the studies, these were not blinded with regard to author, journal or research center.

Table 1
Methodological quality assessment (adapted) of 11 studies on CRA in alcohol, cocaine and opiates addiction

First author, year	Internal validity criteria										External validity criteria													
	1a	1b	2	3	4	5	6	7	8	9a	9b	ξ int.	10a	10b	10c	11	12a	12b	12c	12d	13	14	ξ ext.	ξ int. + ext.
Abbott, 1998b	+	?	+	?	-	+	+	+	+	+	+	8	+	+	-	+	?	+	+	-	-	+	6	14
Azrin et al., 1982	+	-	+	+	-	-	+	+	+	-	+	7	+	+	+	+	+	+	-	+	-	-	7	14
Azrin, 1976	+	-	+	+	-	+	+	-	+	-	-	6	+	-	+	+	+	+	+	-	-	-	7	13
Bickel et al., 1997	+	-	?	?	-	-	+	+	+	+	+	6	+	+	-	+	-	-	-	-	-	+	4	10
Higgins et al., 1991	-	-	-	+	-	-	-	+	+	+	+	5	+	+	+	+	+	+	-	-	-	+	7	12
Higgins et al., 1993	+	+	+	+	-	-	+	+	+	+	+	9	+	+	+	+	+	+	-	+	-	+	8	17
Higgins et al., 1994	+	+	+	+	-	-	+	+	+	+	+	9	+	+	+	+	+	+	-	+	-	+	8	17
Higgins et al., 2000a	+	+	+	+	+	-	+	+	+	+	+	11	+	+	+	+	+	+	-	+	-	+	8	19
Hunt and Azrin, 1973	+	-	+	+	-	+	+	-	+	-	-	6	+	-	+	+	+	+	+	+	-	-	7	13
Miller et al., 2001a,b	+	-	+	-	-	+	+	+	+	+	+	8	+	+	+	+	-	+	-	+	-	+	7	15
Smith et al., 1998	+	+	+	+	+	+	+	+	+	+	+	11	+	+	+	+	+	+	-	+	+	+	9	20

Note: '+' reflects that the study met the criterion, '?' reflects that it was not clear if the study met the criterion, and '-' reflects that a study did not meet the criterion. A total score was obtained by summing the number of positive scored criteria. The following internal criteria were defined, 1a: adequate randomization procedure; 1b: concealment of treatment allocation; 2: withdrawal/drop-out rate; 3: co-interventions avoided or equal; 4: blinding of patients; 5: blinding of observer; 6: intention-to-treat analysis; 7: compliance; 8: similarity of baseline characteristics; 9a: validity of assessment; 9b: relevance of assessment. The external criteria consisted of 10a: description of CRA program; 10b: description of usual care; 10c: definition of CRA; 11: follow-up; 12a: experience; 12b: training in CRA; 12c: tape recording; 12d: according to CRA protocol; 13: sample size; 14: description of subjects.

Disagreements concerning the inclusion of RCTs were resolved by consensus. A third reviewer (MvT) was consulted if consensus was not achieved.

2.3.2. Methodological quality assessment

Two reviewers independently assessed the methodological quality of the RCTs. The criteria list (Table 1) that is recommended in the guidelines for systematic reviews issued by the Cochrane Back Review Group (Van Tulder et al., 2003) was used, but adapted for this CRA review. The full criteria list with operationalization is available on request from the first author. The original criterion "blinding of care-providers" was omitted, because care-providers in the CRA studies could not be blinded for the treatment they provided. Two new items were added (items 9a and 9b in Table 1) in order to assess potential information bias. With regard to the primary effect measure, the results obtained by using standardized and valid measuring instruments, such as blood samples or urine samples give a higher validity of abstinence than self-reports. Furthermore, highly relevant assessments provide more information concerning the primary effect measure than secondary measurements, such as depression questionnaires.

Several external validity items were also added (Table 1). The items 10a, 10b and 10c were added, because a description of the content of the CRA program provides more clarity about what is actually tested and the extent to which the results can be compared to the findings of other studies. Furthermore, a clear explanation of the theoretical background of the experimental program was evaluated positively. "Treatment integrity" influences the extent to which the results can be generalized and replicated. Item 12a indicates the level of experience of the therapists, and 12b indicates whether the therapists have been trained in the application of CRA. Specific training for the experimental

program, together with tape/video-recording to determine adherence (12c), increases the external validity of the study. Moreover, the effects of the administration of an experimental treatment can be improved when a protocol is used (12d).

An item was scored "positive" (+) if the criterion was fulfilled, "negative" (-) if it was not fulfilled, or "unclear" (?). A total score was computed by counting the number of positive scores, and high quality was defined as fulfilling six or more of the 11 internal validity criteria. If the article did not contain information about the methodological criteria, i.e. if one or more criteria were scored "unclear", the authors were contacted for additional information. Scores on the external validity criteria were considered as supplementary information, to give an indication of the extent to which the results of the studies could be generalized.

2.3.3. Data extraction

Two reviewers independently extracted the data concerning the following: study population (disorder, setting, gender and age, addiction severity index composite scores, sample-size and dropouts), interventions (frequency and duration CRA and control group, interventions CRA) and results (follow-up results per outcome measure).

2.3.4. Data analysis

The data from the included studies were merged in a meta-analysis to quantify the effect. Separate meta-analyses were performed for the short (≤ 4 weeks), intermediate (> 4 and ≤ 16 weeks) and long-term (> 16 and ≤ 24 weeks) effects of treatment (Van Tulder et al., 2003). When available, other and longer follow-up periods, up to one year are provided in Table 2 in the result section. The pooled relative risks (RR) were computed with 95% confidence intervals (CI) using the random effects model. A qualitative analysis

Table 2
Study characteristics of included studies

Population						Interventions			Results		
Study	Addiction	Mean age (years)		ASI composite scores (range)		N	Frequency + duration		Interventions	Abstinence	ASI scores/percentage of drinking days/time spent drinking
		CRA	Control	CRA	Control		CRA	Control			
Abbott et al. (1998b)	Opioid	37.0		0.08–0.70	0.05–0.66	180*	week 1-2 2/week. week 3-24 1/week	week 1-2 2/week. week 3-24 1/week	(1) Usual care (<i>n</i> = 67) (2) CRA (<i>n</i> = 52) (3) CRA + RP (<i>n</i> = 62) Note: group 2&3 combined in analysis	CRA groups (89%) vs. Standard (78%), three consecutive weeks free from opiates $\chi^2 = 4.07$, d.f. = 1, <i>P</i> = 0.044	6 months ASI drug composite score in CRA groups vs. standard in favour of CRA; <i>F</i> = 4.37, d.f. = 1, 147, <i>P</i> = .038
Azrin (1976)	Alcohol	XXX		XXX	XXX	18	30 h (1800 min)	XXX	(1) Usual care + disulfiram (<i>n</i> = 9) (2) CRA + disulfiram (<i>n</i> = 9)	XXX	Percent of time spent drinking—>16 weeks ≤ 24 weeks: 2% (2) vs. 55% (1), <i>P</i> < 0.005; after 2 years follow-up in CRA condition, at least 90% abstain from drinking
Azrin et al. (1982)	Alcohol	33.9		XXX	XXX	43	1/week Mean 6.4 sessions	1 Control 1/week 4.9 sessions 2 Control 1/week 4.5 sessions	(1) Usual care + disulfiram (<i>n</i> = 14) (2) Disulfiram compliance program (<i>n</i> = 15) (3) Single CRA + disulfiram (<i>n</i> = 14)	XXX	Number of drinking days/month—>16 weeks ≤ 24 weeks: 0.9 (3) vs. 16.4 (1) vs. 7.9 (2), <i>P</i> < 0.001
Bickel et al., 1997	Opioid	33.6	34.6	0.14–0.56	0.18–0.56	39	3/week 60 min 26 weeks	1/week 37 min 26 weeks	(1) Usual care (<i>n</i> = 20) (2) CRA + abstinence contingent 'incentives' (<i>n</i> = 19)	≤4 weeks: 55% (1) vs. 68% (2), ns; >4 weeks = 16 weeks: 5% (1) vs. 26% (2), χ^2 (1, <i>n</i> = 39) = 3.4, <i>P</i> = 0.06; >16 weeks ≤ 24 weeks: 0% (1) vs. 11% (2), ns	XXX
Higgins (1993, 1995, 1997, 2000b)	Cocaine	28.5	30.1	0.19–0.59	0.17–0.49	38	1–12 weeks 2/week 60 min 12–24 weeks 1/week 60 min	1–12 weeks 2/week 210 min 12–24 weeks 1/week 150 min or 1/week 60 min	(1) CRA + 'incentives' (<i>n</i> = 19) (2) Usual care (<i>n</i> = 19)	≤4 weeks: 74% (1) vs. 16% (2); >4 weeks total ≤ 16 weeks: 68% (1) vs. 11% (2); >16 weeks ≤ 24 weeks: 42% (1) vs. 5% (2), period 3–24 weeks: χ^2 = 7.84, d.f. = 1, <i>P</i> = 0.005; 1 year: 96% (1) vs. 69% (2), χ^2 (1, <i>N</i> = 38) = 7.3, <i>P</i> = 0.007	6 months composite ASI drug, alcohol, family-social and psychiatric scores improved compared to intake

Higgins (1994, 1995, 1997, 2000b)	Cocaine	31.8	30.9	0.11–0.54	0.12–0.65	40	1–12 weeks 2/week 60 min 12–24 weeks 1/week 60 min	1–12 weeks 2/week 60 min 12–24 weeks 1/week 60 min	(1) CRA ($n = 20$) (2) CRA + 'incentives' ($n = 20$).	≤ 4 weeks: 75% (2) vs. 55% (1); >4 weeks ≤ 16 weeks: 55% (2) vs. 25% (1); >16 weeks ≤ 24 weeks: 30% (2) vs. 5% (1); period 1–24 weeks: χ^2 (1) = 4.4, $P = 0.03$; 1 year: 13 (20) vs. 12 (20), ns	6 months composite ASI drug, alcohol, family-social and psychiatric scores improved compared to intake
Higgins (2000a,b)	Cocaine	30.8	30.0	0.17–0.49	0.12–0.53	70	1–12 weeks 2/week 75 min 12–24week 1/week 75 min 24 weeks	1–12 weeks 2/week 75 min 12–24week 1/week 75 min 24 weeks	(1) CRA + 'incentives' (independent of urine sample) ($n = 34$) (2) CRA + 'incentives' contingent on abstinence ($n = 36$).	>4 weeks ≤ 16 weeks: 45% (2) vs. 30% (1); χ^2 (1, $N = 70$) = 1.69, $P = 0.19$; >16 weeks ≤ 24 weeks: 20% (2) vs. 10% (1); χ^2 (1, $N = 70$) = 1.60, $P = 0.20$	6 months composite ASI drug, alcohol, family-social and psychiatric scores improved compared to intake
Higgins et al. (1991)	Cocaine	29.0	30.5	0.21–0.57	0.21–0.46	25	2/week 60 min 12 weeks	2/week 60 min 12 weeks	(1) CRA ($n = 13$) (2) Usual care ($n = 12$)	≤ 4 weeks: 77% (1) vs. 25% (2); >4 weeks ≤ 16 weeks: 46% (1) vs. 0% (2); period 1–12 weeks: $\chi^2 = 10.9$, d.f. = 1, $P = 0.001$	XXX
Hunt and Azrin (1973)	Alcohol	39.9	36.8	XXX	XXX	16	50 h (3000 min)	25 h (1500 min)	(1) Usual care ($n = 8$); (2) Single CRA ($n = 8$)	XXX	Percent of time spent drinking— ≤ 4 weeks: 14% (2) vs. 79% (1), $P < 0.005$; >16 weeks ≤ 24 weeks: 20% (2) vs. 80% (1), $P < 0.005$
Miller (2001a,b)	Alcohol	31.0		XXX	XXX	237	Mean group 3: 9.0 Group 4: 9.6 Group 6: 8.7 sessions	Mean group 1: 9.5 Group 2: 7.9 Group 5: 7.3 sessions	(1) Usual care ($n = 39$) (2) Usual care + disulfiram ($n = 40$) (3) CRA + disulfiram ($n = 40$) (4) CRA ($n = 38$) (5) Usual care ($n = 41^{**}$) (6) CRA ($n = 39^{**}$) Note: 1-4 disulfiram-eligible subjects 5-6 disulfiram-ineligible subjects	>4 weeks ≤ 24 weeks (1) 41.9% (2) 58.8% (3) 34.4% (4) 32.3% (5) 24.0% (6) 22.2%	>4 weeks ≤ 24 weeks; mean drinking days/week: (1) 1.35 (2) 0.25 (3) 0.20 (4) 0.22 (5) 1.69 (6) 1.68
Smith et al. (1998)	Alcohol	38.0		XXX	XXX	106	Mean 39.3 group, 4.6 individual and 3.3 job club sessions	Mean 18.7 AA meetings and 0.8 sessions counseling	(1) Usual care (+ disulfiram) ($n = 42$) (2) CRA (+ disulfiram) ($n = 64$)	>4 weeks ≤ 16 weeks: χ^2 (1, $N = 95$) = 10.614, $P = 0.001$; >16 weeks ≤ 24 weeks: χ^2 (1, $N = 88$) = 8.47, $P = 0.004$	Number of drinking days/week— >4 weeks ≤ 16 weeks: $F(1,88) = 1.56$, $P = 0.2145$; >16 weeks ≤ 24 weeks: $F(1,77) = 8.35$, $P = 0.005$; 1 year: $F(1,70) = 3.32$, $P = 0.0771$

The distribution of the ASI composite scores are reflected in two digits ranging from the lowest to the highest score as mentioned in the study. The studies of Higgins (1995, 1997, 2000b) are not mentioned apart, because these studies contain follow-up assessments. The study of Abbott et al. (1998b) included 180 subjects but used 151, who engaged in treatment, for analysis at 6 months of follow-up as is indicated by *. All studies were out-patient except Hunt and Azrin (1973) and Azrin (1976), which were in-patient. The sample distribution of the alcohol study of Miller (2001a,b) was calculated with data derived from the intention-to-treat sample and percentage of clients attending three or more therapy sessions and is indicated by **.

was also performed using a four-level rating system for the strength of the scientific evidence (Van Tulder et al., 2000):

1. *Strong evidence*: provided by generally consistent findings in multiple high quality RCTs.
2. *Moderate evidence*: provided by generally consistent findings in one high quality RCT and one or more low quality RCTs or by generally consistent findings in multiple low quality RCTs.
3. (A) *Limited evidence*: only one RCT (either high or low quality). (B) *Conflicting evidence*: inconsistent findings in multiple RCTs.
4. *No evidence*: no RCTs.

Generally, consistent findings were defined as 75% or more of the studies having statistically significant findings in the same direction.

3. Results

3.1. Study selection

The search resulted in 66 references via PsycINFO, 90 references in MEDLINE, 24 in EMBASE and 2 in CINAHL. After consulting the additional databases, Biological Abstracts, ERIC, LISA, OSH, Periodical Abstracts, SERFILE and Sociological Abstracts, the search yielded 97 different references. After deleting duplicates from all the databases consulted, the search finally resulted in 167 different references.

The first selection was based on titles, keywords and abstracts, and resulted in both reviewers selecting 26 empirical CRA studies and rejecting 141 studies. Of the rejected studies, 83 were non-CRA and 49 discussed and reviewed CRA but were not RCTs.

Furthermore, another five empirical studies (e.g. Meyers et al., 1998) reported on Community Reinforcement and Family Training (CRAFT) or interventions aimed at the involvement of family members (e.g. Sisson and Azrin, 1986) and an additional four were CRAFT reviews (e.g. Meyers et al., 2001). CRAFT, which is related to CRA, was developed on the basis of the belief that family members can make contributions in helping to persuade resistant substance abusers to seek treatment (Meyers et al., 2001). Many skill-training strategies used in CRAFT are similar to those used in CRA, but are mainly focused on family members. It was therefore decided that CRAFT studies were not within the scope of this review.

Three additional studies were identified through reference checking (Azrin et al., 1994, 1996; Mallams et al., 1982). After reading the full papers, six of the selected 29 CRA studies were excluded because they were not RCTs.

One study (Mallams et al., 1982) was excluded because it did not evaluate a CRA program as defined by the inclusion criteria, and the intervention consisted of one component only ("Social club").

Another study (Schottenfeld et al., 2000) that was excluded investigated the number of alternative activities as main research objective in a population with an opiate as well as a cocaine addiction.

A CRA study to reduce AIDS risk behavior in an opioid-dependent population (Abbott et al., 1998a) did not focus on one of the outcome measures of interest, and was therefore excluded.

One study of sociopathic alcoholics was excluded because it investigated drinking outcomes in three treatment arms: (1) CRA, (2) individually focused cognitive behavioral treatment and (3) usual care (Kalman et al., 2000). However, no data on subjects receiving usual care were available (personal communication Kalman).

The study carried out by Abbott et al. (1999) was excluded because the data set, which was based on Abbott et al. (1998b), compared subjects who had entered a program with or without methadone as transfers from other community methadone programs.

Two studies carried out by Azrin et al. (1994, 1996) included subjects with different diagnoses of psychoactive substances, so they were excluded.

Two studies (Higgins et al., 1995, 2000b) were follow-up studies of previously published research (Higgins et al., 1993, 1994, 2000a), and Higgins et al. (1997) is a reprint of Higgins et al. (1995).

Four studies reported on the same two alcohol trials (Miller et al., 1992; Miller et al., 2001a,b) and homeless people (Smith et al., 1998; Smith and Delaney, 2001). Miller et al. (2001a,b), consisted of two complementary chapters (two search hits) and is therefore considered as one trial in this review. Finally, a total of 11 trials were included (see Tables 1 and 2).

3.2. Methodological quality

The final results of the methodological quality assessment are presented in Table 1. For the critical appraisal of each individual study, 11 internal and 10 external validity criteria were assessed. The percentage of agreement, to assign a positive score, among the two reviewers (HGR and JJB) was 88% for the internal validity criteria and 94% for the external validity criteria. Subsequently, all authors were consulted to check this assessment and to provide relevant information. Three authors responded to the request and provided additional information on eight studies. As a result, 23 of the "unclear" scores were changed to "positive". The additional information from the authors also resulted in 25 of the "negative" scores being changed to "positive".

In general, the methodological quality of the studies included in this review was high (see Table 1). Ten studies had six (>50%) or more positive scores on the internal validity criteria, which was the pre-determined threshold for high quality (Abbott et al., 1998b; Azrin, 1976; Azrin et al., 1982; Bickel et al., 1997; Higgins et al., 1993, 1994, 2000a;

Hunt and Azrin, 1973; Miller et al., 2001a,b; Smith et al., 1998).

Most of the studies did not include a blinded observer (item 5), and it was often unclear whether or not the researcher who performed the treatment allocation was aware of the treatment to which the subject was allocated (item 1b). With regard to the external validity criteria, several studies did not provide the CRA intervention according to a protocol (item 12d) and did not determine the adherence through tape/video-recording (item 12c). Many studies also had a small sample size (item 13).

3.3. Data extraction and study characteristics

Characteristics of the identified studies that were included ($n = 11$) are shown in Table 2. Five studies dealt with CRA in alcohol treatment (Azrin, 1976; Azrin et al., 1982; Hunt and Azrin, 1973; Miller et al., 2001a,b; Smith et al., 1998). The first two studies, which were the seminal studies for the entire CRA treatment, were in-patient studies and compared CRA versus usual care based on Jellinek (1960). The study of Azrin (1976) added a disulfiram compliance-enhancing program to CRA. The first out-patient study (Azrin et al., 1982) compared CRA consisting of behavioral therapy plus a disulfiram assurance program with a disulfiram assurance program and disulfiram alone. The alcohol study carried out by Miller et al. (2001a,b) included two sub-groups: (1) disulfiram-eligible and (2) disulfiram-ineligible clients. The subjects were randomized to six sub-groups. Comparisons were made between usual care (with disulfiram) and (single) CRA (with disulfiram). Finally, one alcohol study dealt with a special population of homeless alcohol-dependent subjects (Smith et al., 1998). In this study, subjects were allocated to various conditions, such as eligible and ineligible for disulfiram. However, this study is based on a simplified two-condition collapsed design with the primary focus on comparing CRA with usual care. A minority of the CRA subjects was assigned to a disulfiram condition, so the CRA condition was considered to be single.

Four studies (Higgins et al., 1991, 1993, 1994, 2000a) examined the effects of CRA with abstinence-contingent 'incentives' in the treatment of cocaine. In two studies (Higgins et al., 1991, 1993) the control group received "12-step counseling" as usual care, which is based on the disease model that is commonly used by community substance abuse clinicians in the US.

One study compared CRA versus CRA with abstinence-contingent 'incentives' (Higgins et al., 1994), and one study (Higgins et al., 2000a) compared elaborate CRA, with abstinence-contingent incentives as an experimental condition, with non-contingent incentives.

Furthermore, two opioid studies were identified. One (Bickel et al., 1997) evaluated the effect of 160 days buprenorphine dose-taper combined with either usual care or a behavioral treatment based on CRA with 'incentives'. The other study (Abbott et al., 1998b) compared the ef-

fects of CRA and usual care in a methadone maintenance program.

Three early studies reported their results in such a way that it was not possible to include them in the statistical pooling with respect to continuous variables, because they only provided means and no standard deviations (Azrin, 1976; Azrin et al., 1982; Hunt and Azrin, 1973). Data pertaining to time to relapse was not provided by the included studies, so no further considerations could be made.

3.4. Effectiveness of CRA in alcohol treatment aimed at abstinence

3.4.1. Single CRA versus usual care

Three high quality studies that were identified compared single CRA with usual care without disulfiram (Hunt and Azrin, 1973; Miller et al., 2001a,b; Smith et al., 1998).

The first study, which is the first CRA study, showed the effectiveness of CRA in treating alcohol-dependence in an in-patient setting, focusing on several aspects of life such as employment and time spent away from home (Hunt and Azrin, 1973). At 6 months follow-up the CRA group showed a significantly lower percentage of 'time drinking' than the usual care group (14% versus 79%; $P < 0.005$). One limitation concerns the CRA treatment package. The early version(s) of CRA had technically fewer components available, and gradual decreased the number of counseling hours. Despite this, the number of treatment sessions of more recent CRA studies might depend on the type (severity) of target population being treated.

In the out-patient study carried out by Miller et al. (2001a,b) no difference was found between single CRA (22.2%) and usual care (24.0%) with regard to abstinence during 1–6 months and 16–24 months follow-up periods in subjects who were disulfiram-ineligible. The same was found with regard to the number of drinking days per week. There was also no statistically significant difference in abstinence between the usual care group and the CRA group in disulfiram-eligible subjects (41.9% versus 32.3%). However, the CRA group performed much better, than the usual care group, with regard to the number of drinking days per week (0.22 versus 1.35).

A critical statement must be made concerning the 'contamination' of the research groups; 51.3% of the subjects in the usual care group and 18.4% of the subjects in the CRA group accepted disulfiram, despite ascertainment of the treatment condition. Subjects in the usual care group were encouraged to take disulfiram, in contrast to subjects in the CRA group.

In the third high quality RCT involving homeless alcoholics (Smith et al., 1998), participants in the CRA program had statistically significantly higher continuous abstinence rates, ranging from 2 months to 1 year after intake (at 8 weeks: $\chi^2(1) = 10.61$, $P = 0.001$; at 16 weeks: $\chi^2(1) = 8.47$, $P = 0.004$; at 36 weeks: $\chi^2(1) = 7.16$, $P = 0.01$). The same significant findings applied to the number of

drinking days. However, some critical comments should be made: the study included a specific population, and only a minority of the subjects (disulfiram-eligible and motivated to comply) took disulfiram. In the analyses, the sub-groups were combined and in this review they are considered to have received no disulfiram.

The number of drinking days (continuous variable) reported by Miller et al. (2001a,b) and Smith et al. (1998) were merged into a meta-analysis. The data from the proximal follow-up (Miller et al., 2001a,b) and the 6-month follow-up data (Smith et al., 1998) were considered as long-term effects ($16 < \text{weeks} \leq 24$). Using the random effects model, the number of drinking days was (WMD(95% CI) = -0.94 (-1.60 to -0.27 , $Q = 2.75$, d.f. 2)) in favor of CRA. With respect to this statistical pooling, the potential source of heterogeneity regarding the follow-up, population and disulfiram eligibility affects the interpretation of this robust finding and should be considered with caution.

Overall, there is strong evidence (level 1) that single CRA is more effective than usual care with regard to number of drinking days, and there is conflicting evidence (level 3) with regard to continuous abstinence.

3.4.2. CRA with disulfiram versus usual care with disulfiram

Three of the studies that were included (Azrin, 1976; Azrin et al., 1982; Miller et al., 2001a,b) compared CRA with disulfiram versus usual care with disulfiram. The inpatient study carried out by Azrin (1976), which was of high quality, showed significant results at 6 months follow-up in favor of CRA with disulfiram in terms of time drinking (2% versus 55%, $P < 0.005$), employment, time spent away from home and time institutionalized. These benefits were maintained for at least 2 years following discharge from the hospital.

The high quality study carried out by Azrin et al. (1982), which included three treatment conditions, also compared CRA with disulfiram versus usual care with disulfiram. At 6 months follow-up, the percentage of time drinking was significantly lower in the CRA with disulfiram group than in the control group (3% versus 55%, $P < 0.01$). The CRA with disulfiram group also showed a statistically significant difference with regard to amount of alcohol consumed and ethanol intoxicated moments.

A limitation concerns the acceptance of disulfiram. In the group receiving usual care, based on Jellinek (1960), disulfiram use was encouraged. However, compliance in the usual care and in the disulfiram condition was extremely poor (Azrin et al., 1982): the mean number of days of disulfiram consumption was 0 in the usual care with disulfiram group versus 24.8 in the CRA with disulfiram group ($P < 0.001$). The total CRA therapy program was reduced from an average of 30 h (Azrin, 1976) to 6.4 h (Azrin et al., 1982), which also complicates comparison of the two studies.

In a high quality study, Miller et al. (2001a,b) found some evidence in favor of usual care: 58.8% of the subjects re-

ceiving usual care with disulfiram, were still abstinent at 1–6 months of follow-up, compared to only 34.4% in the CRA with disulfiram group. This result was not statistically significant. At long-term follow-up (16–24 months) this difference had dissipated. There was also no statistically significant difference in drinking days per week (0.20 in the CRA group versus 0.25 in the usual care group). A critical comment can be made with respect to treatment integrity. The usual care with disulfiram, used a compliance procedure (Sisson and Azrin, 1986), which can also be regarded as a part of a CRA program. This may have reduced the contrast. In the usual care group, 90% of the subjects accepted disulfiram, and over 80% were rated by the therapist as compliant. In the CRA with disulfiram group, 56.4% accepted disulfiram and 44.1% were compliant. All subjects treated in these two groups were disulfiram-eligible. The study carried out by Miller et al. (2001a,b) also shows that when data is combined during follow-up (1–6 months), the subjects in the disulfiram-eligible group, who received CRA were drinking on significantly fewer days (3% versus 19%, $P < 0.001$) than the subjects in the usual care group.

In summary, there is moderate evidence (level 2) that CRA with disulfiram is more effective than usual care with disulfiram in terms of number of drinking days, and limited evidence (level 3) that there is no difference in effect between CRA with disulfiram and usual care with disulfiram in terms of continuous abstinence.

3.5. Effectiveness of CRA in cocaine treatment aimed at abstinence

3.5.1. Single CRA versus usual care

No RCTs were identified that examined the effects between single CRA and usual care, so there is no evidence (level 4).

3.5.2. CRA with abstinence-contingent 'incentives' versus usual care

A meta-analysis was conducted on two studies (Higgins et al., 1991, 1993), the latter of which was of high quality, to determine the effect of CRA with 'incentives' versus usual care (details are presented in Table 2). Using the random effects model, the pooled relative risk for cocaine abstinence in a CRA treatment program with a duration of 4 weeks or less was 3.75 (95% CI 1.79–7.87, $Q = 0.31$, d.f. 1), and for a CRA treatment program with a duration between 4 and 16 weeks it was 5.09 (95% CI = 1.63–15.86, $Q = 0.44$, d.f. 1).

There is strong evidence (level 1) that CRA with 'incentives' is more effective with regard to cocaine abstinence than usual care.

3.5.3. CRA with abstinence-contingent 'incentives' versus CRA (non-contingent incentives)

Two studies (Higgins et al., 1994, 2000a), both high quality RCTs, determined the effect of CRA with abstinence-

contingent ‘incentives’ versus CRA (non-contingent incentives). Higgins et al. (1994) examined the difference between CRA versus CRA with abstinence-contingent ‘incentives’, and Higgins et al. (2000a) compared CRA both with and without abstinence-contingent ‘incentives’. In the latter study, all patients received CRA and the experimental condition depended on whether it was combined with cocaine abstinence-contingent vouchers or vouchers provided independent of cocaine use (details are presented in Table 2). For the purpose of statistical pooling, the CRA with non-contingent ‘incentives’, which attenuates clinical homogeneity, was considered to be single CRA. The results of this pooling were calculated for an intermediate term, as no short-term data were available. The pooled effect size for cocaine abstinence in a CRA treatment program with a duration of 4–16 weeks was 1.73 (95% CI = 1.04–2.88, $Q = 0.48$, d.f. 1).

There is strong evidence (level 1) that CRA with abstinence-contingent ‘incentives’ is more effective than single CRA (non-contingent incentives) treatment aimed at cocaine abstinence.

3.6. Effectiveness of CRA in opioid treatment aimed at abstinence

3.6.1. CRA with ‘incentives’ versus usual care in a detoxification program

One identified RCT (Bickel et al., 1997) compared a 160-day buprenorphine dose-taper combined with either usual care or a behavioral treatment based on CRA with ‘incentives’. Fifty-three percent of the subjects receiving CRA with ‘incentives’ completed the treatment, versus 20% receiving usual care (χ^2 (1, $N = 39$) = 4.5, $P = 0.03$). In the short-term (≤ 4 weeks), the CRA with ‘incentives’ was more effective (68%) in terms of continuous abstinence than usual care (55%), but this was not statistically significant. In the intermediate term, more participants in the CRA with ‘incentives’ (47%) achieved at least 8 weeks of continuous abstinence (χ^2 (1, $N = 39$) = 4.8, $P = 0.03$), compared to usual care (15%). In the long term (>16 weeks ≤ 24), there was still a difference (11% versus 0%), but this was not statistically significant.

Hence, there is limited evidence (level 3) that CRA with ‘incentives’ is more effective than usual care in a detoxification program.

3.6.2. CRA with ‘incentives’ versus single CRA in a detoxification program

No RCTs were identified that examined the effects of CRA with ‘incentives’, either separately or versus usual care, so there is no evidence (level 4).

3.6.3. CRA versus usual care in a relapse prevention program

No RCTs could be identified, so there is no evidence (level 4).

3.6.4. Single CRA versus usual care in a methadone maintenance program

One RCT (Abbott et al., 1998b) was identified, with three treatment arms: usual care, CRA, and CRA with relapse prevention (CRA/RP). We considered methadone maintenance to substitute and prevent illegal drug use. In the long term (>16 weeks) CRA was significantly more effective than the usual care, based on the consecutive (3 weeks) opiate-negative urine analysis (84% versus 78%) and the 6-month ASI composite scores. However, there might be some limitations in this study. Firstly, with regard to the design: combining treatment arms 2 (CRA) and 3 (CRA with relapse prevention). Nevertheless, by the time of 6-month follow-up the mean number of RP sessions was 1.06. When this number is contrasted with the attended 20 CRA session, one could say that these conditions are essentially the same and legitimize collapsing. Secondly, in the follow-up: 29% of the urine samples were missing.

Hence, there is limited evidence (level 3) that single CRA is more effective than usual care in a methadone maintenance program.

4. Discussion

4.1. Clinical implications

In general, there is limited to moderate evidence for the efficacy of CRA with or without medication or contingency management in various substance-related disorders, including alcohol, cocaine and heroin. It can be argued that the collapsing of alcohol, cocaine and opioid findings might cause a misinterpretation of this meta-analysis. For instance, the voucher approach is often used in the CRA drug treatment (via dichotomous variable) and is, in general, absent in the alcohol treatment. Also the support for the effectiveness on CRA with alcohol abusers is rather bit stronger than for the drug populations. Additionally, the reported findings vary substantially depending on the type of variable are reviewed (e.g. alcohol outcomes with respect to dichotomous and continuous variables).

On the other hand, the combining of the meta-analysis’ findings seems legitimate, because one could ask: why to distinguish studies on the basis of the drug of dependence? CRA addresses the behavior of addiction; not the physiological basis derived from the drug that is being used. It seems viable that the focus on the outcome of abstinence is comparable across various substance types (Gowing, 2003, personal communication).

Due to the course of the progression of addiction, which is similar to that of chronic diseases (O’Brien, 2003), there is a cumulating of evidence to view addiction as a chronic, relapsing brain disease (Leshner, 1997; McLellan, 2002; Van den Brink et al., 2003). In general, this view has generated a variety of treatment goals, such as crisis intervention, stable abstinence, stabilization of substance use and

improving quality of life (harm-minimization) and palliation (Van den Brink et al., 2003). These different treatment goals determine the type of defined outcome measures, which in turn, correspond to the different treatment goals such as abstinence (e.g. Azrin, 1976; Higgins et al., 1993) and harm-minimization (e.g. Abbott et al., 1998a). This view of chronic disease legitimizes a focus on the choice continuous outcome variables rather than dichotomous variables. Although we defined outcome measures such as addiction severity, frequency of substance abuse and time to relapse, data was often not provided. In addition, analogue to these treatment goals, the use of pharmacological agent such as disulfiram is solely associated with abstinence in the treatment of alcohol abuse and renders also the goal of a concomitant psychosocial therapy such as CRA. Nevertheless, with respect to the palette of treatment goals the choice to focus on abstinence can be argued. The more sensitive nature of continuous measures might provide a better outcome perspective for CRA. But abstinence is the outcome measure that is most easily assessed objectively and hence becomes the obvious primary outcome indicator, as identified in the methods section (Gowing, 2003, personal communication).

Currently, three dominant researchers are conducting studies in the CRA area: Nathan Azrin, Stephen Higgins and Bob Meyers. In nearly all included studies Azrin, Meyers and Higgins are directly involved as (co)authors.

Most of the included studies were of high methodological quality. Only a few studies could be identified within each type of comparison, i.e. CRA versus usual care and CRA versus CRA with contingency management for alcohol, cocaine and opioid abuse.

With respect to the alcohol studies, it was demonstrated that there is limited evidence (level 3) that single CRA with or without disulfiram is more effective, in terms of continuous abstinence, than usual care. However, there is moderate evidence (level 2) that single CRA with or without disulfiram is more effective than usual care in terms of number of drinking days. Furthermore, these results that favor CRA support the findings that CRA is also effective in the treatment of alcohol abuse in specific populations, some of which have severe life problems, such as homeless (Smith et al., 1998; Smith and Delaney, 2001). Other specific populations have also been the subject of research on CRA: Dine' (Navajo) people and sociopathic alcoholics (Kalman et al., 2000).

It is noteworthy that significantly more disulfiram-eligible clients than disulfiram-ineligible subjects were completely abstinent during 1–6 months of follow-up (Miller et al., 2001a,b). However, as previously noted, the treatment integrity of the study of Miller (2001a,b) was affected because the usual care condition with disulfiram used a CRA compliance procedure (Sisson and Azrin, 1986). From its inception, it seems important to advocate procedures in CRA (i.e. via significant authors) to increase acceptance and compliance with the medication regime (e.g. Sisson and Azrin, 1986). An important finding was the interaction between ef-

fectiveness of disulfiram compliance procedure and marital status of the subjects ($F(2, 41) = 6.12, P < 0.006$). For married subjects who participated in the full CRA program, the therapy outcome showed no improvement (Azrin et al., 1982).

Higgins and his co-workers investigated two operant-oriented programs for the treatment of cocaine dependence: community reinforcement and contingency management via 'incentives'. There is strong evidence that the combination package (CRA with contingency management) is superior to usual care (level 1) or CRA with non-contingent 'incentives' (level 1). In every study, CRA with abstinence-contingent 'incentives' is significantly more effective than usual care in cocaine-dependent subjects.

However, the fact that this treatment package consists of two combined operant-oriented methods is a limitation. These cocaine studies do not address single CRA, so there is no evidence that single CRA is more favorable than usual care. A recent RCT demonstrated that there is no evidence that CRA produces larger effect sizes than vouchers in cocaine abusers. Nevertheless, with regard to alcohol use, employment, and other outcomes, CRA produced greater effects than vouchers (Higgins et al., 2003).

Furthermore, on base of urinalyses, it seems clear that the effect of incentives, as a part of a larger CRA intervention, dissipates slowly after discontinuation. The collapsing of the data provided by Higgins et al. (1994, 2000a) should be interpreted with caution. In a certain degree the collapsing seems understandable, however, we do not know how it affected other variables; the clients experience.

Another critical comment that can be made regarding external validity concerns the relatively low ASI composite scores. This is possibly associated with the enrolment of the participants, who were mainly recruited through advertisements in newspapers and via public service announcements on different media channels. This might affect the generalizability of the results to different study populations. In general, the severity of the symptoms worsens the prognoses (McLellan et al., 1983). Furthermore, it should be noted that the same research team conducted all the RCTs that were identified.

The literature search revealed that small naturalistic studies have also been conducted to assess the efficacy of CRA with contingent management in cocaine and marijuana abuse (Budney et al., 1991; Vick and Houden, 1991), and even in an individual with a dual diagnosis (Fix, 2001). A larger study has also been conducted to examine the power of CRA in a population with mainly cocaine and marijuana abuse (Azrin et al., 1994). This study demonstrated that CRA, even when the worst case analysis was conducted, was superior to supportive counseling in reducing the mean number of days of drug use at the end of 8 months of treatment (49.1% versus 78.3%, $P < 0.003$) and the effect sustained after 9 months of follow-up (52.8% versus 80.4%, $P < 0.004$; Azrin et al., 1996). Urine analysis supported this outcome in the last month of treatment ($\chi^2(1) = 6.05, P = 0.014$).

At follow-up, there was a statistically non-significant trend in favor of CRA ($\chi^2(1) = 3.38, P < 0.066$).

There were no RCTs that determined the effect of single CRA in an opioid detoxification or a relapse prevention program to treat opioid dependency. Nevertheless, one naturalistic study that was identified examined the role of CRA during a rapid opioid detoxification process and, additionally, CRA in a naltrexone maintenance program aimed at abstinence, which showed promising results (Roozen et al., 2003).

Hence, with respect to the CRA programs focussing on opioid substitution (Abbott et al., 1998b), detoxification (Bickel et al., 1997) and abstinence (Roozen et al., 2003), it seems that, there is limited evidence and optimistic and promising research findings. Abbott et al. (1998a) examined the role of CRA in risk behavior, including injection drug use and high-risk sexual behavior to prevent AIDS. These types of behavior were significantly, although comparably reduced in all treatment groups (Higgins and Abbott, 2001). In the treatment of opioid dependence, CRA could be an option to realize further optimization of the treatment outcome.

Based on the results of a variety of cocaine and opioid studies it becomes clear that abstinence-contingent incentives are an effective approach. This reinforcement principle is also a basic premise of CRA, and is supported by Azrin et al. (1996) who stated: “the favorable results appear attributable to the inclusion of a significant other in therapy and the use of reinforcement abstinence contingent ‘incentives’”. Problems might be encountered in the implementation of abstinence-contingent incentives in clinical routine practice, but pertaining to the token economy, there might be options that could make this approach feasible (cf. Franco et al., 1995).

CRA is associated with relatively intensive and time-consuming treatment (Barber, 1992). The initial study (Hunt and Azrin, 1973) took an average CRA time of 50 h. This was reduced to 30 h in the next study (Azrin, 1976) and was completed in approximately 6 h in the Azrin study in 1982. These data suggest that claims about the high treatment and labor intensity can be refuted. It has recently been demonstrated that CRA treatment can improve many aspects of life in approximately five sessions over a period of in 4–6 weeks. Subsequently, the CRA treatment can be tailored and adapted to individual goals, varying from life-long abstinence to moderation of substance use (Miller, 2001c).

As previously discussed, a limitation of this review is the absence of dependent measures such as the amount of alcohol consumed, blood alcohol concentrations or the number of non-drug related activities. The inclusion of such continuous measures might be considered as direct measures of the effectiveness of CRA.

Another limitation concerning the conducted analyses is the elimination of the early CRA studies from the statistical pooling due to insufficient data available.

4.2. Research implications

Most studies included in this systematic review evaluated a cognitive behavioral ‘treatment package’. A CRA manual for the treatment of alcohol abuse that has been published describes the appropriate CRA elements for clinical use (Meyers and Smith, 1995). A treatment manual is also available for the combined approach in the treatment of cocaine dependence (CRA and vouchers, Budney and Higgins, 1998), which was used as a guideline in nearly all of the identified cocaine studies.

One limitation is that we know little about the actual or comparative value of the different elements within CRA. Although we have underlined some critical elements, it is still unclear which element within the CRA framework is the most effective, and which components of CRA are necessary and which are superfluous. A conceptual analysis appears to be necessary. This seems especially relevant now that the biopsychosocial model has been widely accepted and multi-dimensional approaches are gaining terrain in the treatment of addiction. Among the possible key elements of CRA that have been suggested is a CRA pharmacotherapy-compliance procedure (Sisson and Azrin, 1986), to encourage taking pharmacological agents under supervision in order to prevent omissions of medication intake and to increase adherence to treatment. This in turn, results in a reduction in therapy time, thus reducing costs and increasing benefits (e.g. Azrin et al., 1982; Miller et al., 2001a,b). In several studies CRA outperformed other treatment modalities in terms of participation in non-drug-related activities (i.e. Higgins et al., 2003; Schottenfeld et al., 2000). The latter authors suggested that reinforcement of non-drug-related social, vocational, and recreational activities are a crucial component of CRA. This is also supported by Mallams et al. (1982), who suggested that a peer group social reinforcement (i.e. community social club) should be arranged to improve therapy outcome. These non-substance-related reinforcement activities seem to be an important element of CRA to maintain a long-term substance-free lifestyle.

Future RCTs should aim at identification of the most effective components of CRA programs. In addition to maintaining high internal validity, efforts should be made to conduct RCTs with a high(er) external validity. Considerable attention should be paid to training therapists in the application of CRA, and making tape recordings or similar procedures to assess treatment integrity. It is therefore a prerequisite that CRA procedures are protocol-based. Additionally, a clear description of the control program (usual care) should also be given.

We recommend:

1. More high quality RCTs of CRA in the treatment of alcohol, cocaine and opioid addiction.
2. RCTs conducted by other research groups in different countries and/or different settings to confirm the most promising findings.

3. RCTs focusing on the severity of addiction.
4. RCTs with a larger sample size, which is determined by a power analysis.
5. RCTs including CRA treatments that are protocol-based and adherence determined through tape/video-recording.
6. More RCTs with a follow-up of one year or longer.
7. RCTs of CRA with and without 'incentives' with multiple follow-up measurements.

Acknowledgements

We would like to thank Linda Gowing, Ph.D. and Stephen Higgins, Ph.D. for their comments on an earlier draft. We also thank Mario ter Smitten for his assistance in the search strategy.

The Ministry of Health, Welfare and Sports (VWS) and (ZonMw) funded this project under grants 3100.0019. These agencies had no role in the conduct, interpretation, or analysis of the study.

References

- Abbott, P.J., Moore, B.A., Delaney, H.D., Weller, S.B., 1999. Retrospective analysis of additional services for methadone maintenance patients. *J. Subst. Abuse Treat.* 17, 129–137.
- Abbott, P.J., Moore, B.A., Weller, S.B., Delaney, H.D., 1998a. AIDS risk behavior in opioid dependent patients treated with community reinforcement approach and relationships with psychiatric disorders. *J. Addict. Dis.* 17, 33–48.
- Abbott, P.J., Moore, B.A., Weller, S.B., Delaney, H.D., 1998b. Community reinforcement approach in the treatment of opiate addicts. *Am. J. Drug Alcohol Abuse* 24, 17–30.
- Azrin, N.H., Acierno, R., Kogan, E.S., Donohue, B., Besalel, V.A., McMahon, P.T., 1996. Follow-up results of supportive versus behavioral therapy for illicit drug use. *Behav. Res. Ther.* 34 (1), 41–46.
- Azrin, N.H., McMahon, P.T., Donohue, B., Besalel, V.A., Lapinski, K., Kogan, E.S., Acierno, R., Galloway, E., 1994. Behavior therapy for drug abuse: a controlled treatment-outcome study. *Behav. Res. Ther.* 32, 857–866.
- Azrin, N.H., 1976. Improvements in the community reinforcement approach to alcoholism. *Behav. Res. Ther.* 14, 339–348.
- Azrin, N.H., Sisson, R.W., Meyers, R., Godley, M., 1982. Alcoholism treatment by disulfiram and community reinforcement therapy. *J. Behav. Ther. Exp. Psychiatry* 13, 105–112.
- Barber, J.G., 1992. Relapse prevention and the need for social interventions. *J. Subst. Abuse Treat.* 9, 157–158.
- Bickel, W.K., Amass, L., Higgins, S.T., Badger, G.J., Esh, R., 1997. Effects of adding behavioral treatment to opioid detoxification with buprenorphine. *J. Consult. Clin. Psychol.* 65, 803–810.
- Budney, A.J., Higgins, S.T., 1998. National Institute on Drug Abuse Therapy Manuals for Drug Addiction: Manual 2. A Community Reinforcement Approach: Treating Cocaine Addiction (NIH Publication No. 98-4309). US Department of Health and Human Services, Rockville, MD.
- Budney, A.J., Higgins, S.T., Delaney, D.D., et al., 1991. Contingent reinforcement of abstinence with individuals abusing cocaine and marijuana. *J. Appl. Behav. Anal.* 24, 657–665.
- Dickersin, K., Scherer, R., Lefebvre, C., 1994. Identifying relevant studies for systematic reviews. *Br. Med. J.* 309, 1286–1291.
- Finney, J.W., Monahan, S.C., 1996. The cost-effectiveness of treatment for alcoholism: a second approximation. *J. Stud. Alcohol* 57, 229–243.
- Fix, J.R., 2001. An application of the community reinforcement approach to the treatment of a dually diagnosed individual. *Sci. Eng.* 61, 6704. Dissertation Abstracts International: Section B.
- Franco, H., Galanter, M., Castaneda, R., Patterson, J., 1995. Combining behavioral and self-help approaches in the in-patient management of dually diagnosed patients. *J. Subst. Abuse Treat.* 12 (3), 227–232.
- Higgins, S.T., Budney, A.J., Bickel, W.K., Badger, G.J., Foerg, F.E., Ogden, D., 1997. Out-patient behavioral treatment for cocaine dependence: one-year outcome. In: Marlatt, G.A., VandenBos, G.R. (Eds.), *Addictive Behaviors: Readings on Etiology, Prevention, and Treatment* (pp. 629–645). American Psychological Association, Washington, DC, US. xxv, 930 pp.
- Higgins, S.T., Abbott, P.J., 2001. CRA and treatment of cocaine and opioid dependence. In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement approach to addiction treatment*, Cambridge University Press, pp. 123–146.
- Higgins, S.T., Budney, A.J., Bickel, W.K., Badger, G.J., Foerg, F.E., Ogden, D., 1995. Out-patient behavioral treatment for cocaine dependence: one year outcome. *Exp. Clin. Psychopharmacol.* 3, 205–212.
- Higgins, S.T., Budney, A.J., Bickel, W.K., Foerg, F.E., Donham, R., Badger, G.J., 1994. Incentives improve outcome in out-patient behavioral treatment of cocaine dependence. *Arch. Gen. Psychiatry* 51, 568–576.
- Higgins, S.T., Budney, A.J., Bickel, W.K., Hughes, J.R., Foerg, F.E., Badger, G., 1993. Achieving cocaine abstinence with a behavioral approach. *Am. J. Psychiatry* 150, 763–769.
- Higgins, S.T., Delaney, H.D., Budney, A.J., Bickel, W.K., Hughes, J.R., Foerg, F.E., Fenwick, J.W., 1991. A behavioral approach to achieving initial cocaine abstinence. *Am. J. Psychiatry* 148, 1218–1224.
- Higgins, S.T., Sigmon, S.C., Wong, C.J., Heil, S.H., Badger, G.J., Donham, R.L., Anthony, S., 2003. Community reinforcement therapy for cocaine-dependent out-patients. *Arch. Gen. Psychiatry* 60, 1043–1052.
- Higgins, S.T., Wong, C.J., Badger, G.J., Haug Ogden, D.E., Dantona, R.L., 2000a. Contingent reinforcement increases cocaine abstinence during out-patient treatment and 1 year follow-up. *J. Consult. Clin. Psychol.* 68, 64–72.
- Higgins, S.T., Badger, G.J., Budney, A.J., 2000b. Initial abstinence and success in achieving longer term cocaine abstinence. *Exp. Clin. Psychopharmacol.* 3, 205–212.
- Holder, H., Longabaugh, R., Miller, W.R., Rubonis, A., 1991. The cost effectiveness of treatment for alcoholism: a first approximation. *J. Stud. Alcohol* 52, 517–540.
- Hunt, G.M., Azrin, N.H., 1973. A community reinforcement approach to alcoholism. *Behav. Res. Ther.* 11, 91–104.
- Jellinek, E.M., 1960. *The Disease Concept of Alcoholism*. New Haven, College and University Press, CT.
- Kadden, R.M., 2001. Behavioral and cognitive-behavioral treatments for alcoholism: Research opportunities. *Addict. Behav.* 26 (4), 489–507.
- Kalman, D., Longabaugh, R., Clifford, P.R., et al., 2000. Matching alcoholics to treatment: failure to replicate finding of an earlier study. *J. Subst. Abuse Treat.* 19, 183–187.
- Leshner, A.I., 1997. Addiction is a brain disease, and it matters. *Science* 278, 45–47.
- Mallams, J.H., Godley, M.D., Hall, G.M., Meyers, R.J., 1982. A social systems approach to resocializing alcoholics in the community. *J. Stud. Alcohol* 43, 1115–1123.
- McLellan, A.T., Luborski, L., O'Brien, C.P., Woody, G.E., 1980. An improved diagnostic evaluation instrument for substance abuse patients: the addiction severity index. *J. Nerv. Ment. Dis.* 168, 26–33.
- McLellan, A.T., Luborski, L., Woody, G.E., Druley, K.A., O'Brien, C.P., 1983. Predicting response to drug and alcohol treatments: role of psychiatric severity. *Arch. Gen. Psychiatry* 40, 620–625.
- McLellan, A.T., 2002. Have we evaluated addiction treatment correctly? Implications from a chronic care perspective. *Addiction* 7, 249–252.
- Meyers, R.J., Smith, J.E., 1995. *Clinical Guide to Alcohol Treatment: The Community Reinforcement Approach*. Guilford Press, New York, USA.

- Meyers, R.J., Miller, W.R., Smith J.E., 2001. Community reinforcement and family training (CRAFT). In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement Approach to Addiction Treatment*. Cambridge University Press, pp. 147–160.
- Meyers, R.J., Miller, W.R., Hill, D.E., et al., 1998. Community reinforcement and family training (CRAFT): engaging unmotivated drug users in treatment. *J. Subst. Abuse* 10, 291–308.
- Miller, E.J., 2001c. Practice and promise: the Azrin studies. In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement Approach to Addiction Treatment*. Cambridge University Press, pp. 8–27.
- Miller, W.R., Meyers, R.J., Tonigan, J.S., 2001a. A comparison of CRA and traditional approaches. In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement Approach to Addiction Treatment*. Cambridge University Press, pp. 62–78.
- Miller, W.R., Meyers, R.J., Tonigan, J.S., Grant, K.A., 2001b. Community reinforcement and traditional approaches: findings of a controlled trial. In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement Approach to Addiction Treatment*. Cambridge University Press, pp. 79–103.
- Miller, W.R., Wilbourne, P.L., 2002. Mesa Grande: a methodological analysis of clinical trials of treatments for alcohol use disorder. *Addiction* 97, 265–277.
- Miller, W.R., Wilbourne, P.L., Hettema, J.E., 2003. What works? A summary of alcohol treatment outcome research. In: Hester, R.K., Miller, W.R. (Eds.), *Handbook of Alcoholism Treatment Approaches: Effective Alternatives*, 3rd ed. Allyn & Bacon, Boston, MA, pp. 13–63.
- Miller, W.R., Andrews, N.R., Wilbourne, P., Bennett, M.E., 1998. A wealth of alternatives: effective treatments for alcohol problems. In: Miller, W.R., Heather, N. (Eds.), *Treating Addictive Behaviors: Processes of Change*, second ed. Plenum Press, New York, pp. 203–216.
- Miller, W.R., Brown, R.K., Simpson, T.L., Handmaker, N.S., Bien, T.H., Luckie, L.F., Montgomery, H.A., Hester, R.K., Tonigan, J.S., 1995. What works? A methodological analysis of the alcohol treatment outcome literature. In: Hester, R.K., Miller, W.R. (Eds.), *Handbook of Alcoholism Treatment Approaches: Effective Alternatives*, second ed. Boston: Allyn & Bacon, pp. 12–44.
- Miller, W.R., Meyers, R.J., Tonigan, J.S., Hester, R.K., 1992. Effectiveness of the Community Reinforcement Approach: Final Progress Report to the National Institute on Alcohol Abuse and Alcoholism. University of New Mexico, Center on Alcoholism, Substance Abuse, and Addictions, p. 56.
- O'Brien, C.P., 2003. Research advances in the understanding and treatment of addiction. *Am. J. Addict.* 12 (Suppl 2), 536–547.
- Roozen, H.G., Kerkhof, A.J.F.M., van den Brink, W., 2003. Experiences with an out-patient relapse program (community reinforcement approach) combined with naltrexone in the treatment of opioid-dependence: effect on addictive behaviors and the predictive value of psychiatric comorbidity. *Eur. Addict. Res.* 9 (2), 53–58.
- Schottenfeld, R.S., Pantalon, M.V., Chawarski, M.C., Pakes, J., 2000. Community reinforcement approach for combined opioid and cocaine dependence: patterns of engagement in alternate activities. *J. Subst. Abuse Treat.* 18, 255–261.
- Sisson, R.W., Azrin, N.H., 1986. Family member involvement to initiate and promote treatment of problem drinkers. *J. Behav. Ther. Exp. Psychiatry* 17, 15–21.
- Smith, J.E., Delaney, H.D., 2001. CRA with the homeless. In: Meyers, R.J., Miller, W.R. (Eds.), *A Community Reinforcement Approach to Addiction Treatment*. Cambridge University Press, pp. 104–122.
- Smith, J.E., Meyers, R.J., Delaney, H.D., 1998. The community reinforcement approach with homeless alcohol-dependent individuals. *J. Consult. Clin. Psychol.* 66, 541–548.
- Van den Brink, W., Goppel, M., van Ree, J.M., 2003. Management of opioid dependence. *Curr. Opin. Psychiatry* 16, 297–304.
- Van Tulder, M.W., Furlan, A., Bouter, L.M., Bombardier, C., The Editorial Board of the Cochrane Back Review Group 2003. Updated Method Guidelines for Systematic Reviews in the Cochrane Collaboration Back Review Group. *Spine* 28, 1290–1299.
- Van Tulder, M.W., Ostelo, R., Vlaeyen, J.W.S., Linton, S.J., Morley, S.J., Assendelft, W.J.S., 2000. Behavioral treatment for chronic low back pain. A systematic review within the framework of the Cochrane Back Review Group. *Spine* 25 (20), 2688–2699.
- Vick, J.W., Houden, D., 1991. A technology for program maintenance: programming key researcher behaviors in a student housing cooperative. *J. Appl. Behav. Anal.* v24.n4.p667.75.Win.1991.
- Wolfe, B.L., Meyers, R.J., 1999. Cost-effective alcohol treatment: the community reinforcement approach. *Cogn. Behav. Pract.* 6, 105–109.